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## CIVIL ENGINEERING.

### *Steam Engineering in* 1859.*

(Continued from page 301.)

STEAM GENERATION.

In the introductory remarks, our readers will have noticed how carefully any exaggeration has been avoided in speaking of *possible* economics in generating and using steam; and we have taken this course, knowing there are many practical engineers of the present day who do not hesitate to speak of 1½ and even 1 lb. of coal as sufficient to obtain an indicated H. P.; whether such statements will be borne out by any present or future improvements, time will prove. The reason we avoid what may be considered extreme views, is because we wish to stand on firm ground, and have all our statements supported by the general engineering experience of the country.

We propose, therefore, in the spirit of the introductory remarks, to allude simply to facts as they exist, and not to individuals, to attempt to separate the good from the bad, and to point out some of the legitimate improvements that can *always* be realized in the generation of steam, by faith in, and adherence to, the text with which we set out, —that "HEAT IS THE SOURCE OF ALL POWER IN STEAM."

Although the generation of steam or vapor of water has no necessary connexion with the machine in which the steam may be afterwards applied to produce motive power, yet it is generally the custom, in considering results, to mix the two together in such a way as to

*From the Lond. Artizan, June, 1859.

prevent the possibility of arriving at correct conclusions: the diameter of the cylinder is the dimension purchasers look to as the most important, whilst they receive, almost without comment, every variety and size of generator: the consequence of such a practice can be foreseen: the *amount of power* received for a given price varying to the extent of 30 and 40 per cent.

Elaborate and reliable experiments have been made to ascertain the quantity of heat necessary to evaporate a given weight of water, and we receive as ascertained facts the large amount of latent heat in steam, and the different quantities of fuel necessary to raise the temperature of a cubic foot of water from 32° to 212°, and to convert it from 212° into steam. We also take it for granted our readers are familiar with the expansive property of steam; if not, we cannot undertake to supply such elementary information.

In steam boilers we have two distinctive features—the fire-grate and the heating or absorbing surface—and they are so closely connected and mutually dependent on each other, that if the relative proportion between them be altered, there is an immediate alteration in the results.

It happens that inexpensive boilers in construction are not necessarily economical in performance; on the contrary, if a small boiler is required to produce a large supply of steam, the result is a considerable waste of fuel; this remark applies to all descriptions of boilers, for land or sea.

If all the heat developed in the combustion of 1 lb. of the best steam coal be utilized, it will evaporate from 14 lbs. to 15 lbs. of water at 212°. How near do we arrive at such a result in ordinary practice? —certainly not within 40 per cent. Ordinary land and marine boilers do not evaporate more than from 7 lbs. to 8½ lbs. of water at 212° per 1 lb. of fuel; in fact, it has been stated on good authority that the average duty of land boilers in the Lancashire districts does not exceed from 6 lbs. to 7 lbs. of water at 212° evaporated by 1 lb. of coal. There are instances of 10 lbs., 11 lbs., and 11½ lbs. of water at 212° being evaporated by 1 lb. of the best fuel; and if the late Newcastle experiments can be relied on, nearly 13 lbs. was evaporated; but this latter duty in an ordinary marine boiler, although with fresh water, is so far above what is realized in general practice, and so *very near* the theoretical value, that we cannot at present admit it in our calculations; it may, however, be conceded that fully 11 lbs. of water at 212° can be evaporated by 1 lb. of good steam coal,—an improvement of more than 30 per cent. on the general practice of the present day.

In generating steam there are two chief sources of waste—radiation, and the heated gases allowed to escape through the chimney. The first can be partly removed by clothing the boiler with non-conducting material; the second is the most important and the most difficult to contend with.

In locomotives the temperature of the escaping gases is upwards of 1000°; in land boilers, from 400° to 600°; and in marine boilers, from 500° to 900°; in each case depending to a great extent upon the rela-

tive proportion between the fire-grate and the absorbing surface, or, more correctly, between the amount of fuel consumed in a given time and the absorbing surface. And this brings us to the real practical difficulty of combining economy of fuel with the development of great evaporating power in a boiler of a given size and weight.

The amount of evaporation in a given time in steam boilers of the same type, is proportional to some extent to the difference between the temperatures of the escaping heated gases and the water to be evaporated with a given absorbing surface: the higher the temperature of the said gases the greater the evaporation in a given time, and the greater the amount of fuel required to evaporate a given quantity of water. On the other hand, the nearer the temperature of the escaping gases approximates to the temperature of the water to be evaporated, the less the evaporation in a given time, and the less the amount of fuel required to evaporate a given quantity of water.

In the above statements it is assumed in each case the boilers are of similar construction and worked under similar circumstances, the only difference being in the ratios of the absorbing surface to the amount of fuel consumed in any given time: the truth of the above is seen every day. In one case (we state actual instances,) there is a marine boiler having 1600 feet of absorbing surface, and 80 feet of fire-grate, or a ratio of 20 to 1, the combustion is at the rate of 24 lbs. per sq. foot of fire-grate per hour, the escaping gases have a temperature of upwards of 800°, 6¼ lbs. of water is raised from 100° to 260°, and evaporated by 1 lb. of fuel, and 190 cubic feet of water are evaporated per hour, or 1 cubic foot to 8½ sq. feet of absorbing surface.

In another instance, we have a marine boiler of similar construction and proportions, except in the ratio of fire-grate to absorbing surface, the latter being, 1200 sq. ft., and the former 40 sq. ft., or a ratio of 30 to 1. The combustion is at the rate of 16 lbs. per sq. ft. of fire-grate per hour; the escaping gases have a temperature of 450°; 8½ lbs. of water are raised from 100° to 270° and evaporated by 1 lb. of fuel, and 87 cubic ft. of water are evaporated per hour, or 1 cubic ft. to 13¾ sq. ft. of heating surface.

These boilers are working under like circumstances, and, leaving out decimals, the figures given are substantially correct, and fully illustrate the connexion, previously stated to exist, between the temperature of the waste heat and the duty and economy realized.

If engineers had simply to generate steam with the least possible expenditure of fuel, regardless of time, and the cost, weight, and capacity of the generator, the problem could be solved with comparative ease, but the case is totally different; a certain weight of steam has to be produced in the least possible time with the least possible cost, weight, and capacity of the generator, and, above all, with the least possible expenditure of fuel—regard being had also to durability and facilities for repair. Here we have the most conflicting conditions, and it cannot be matter of surprise if mistakes have been, and are being made, it being only necessary that one element be over-valued or another be under-valued, to insure an unsatisfactory result. One manu-

facturing engineer swears by his fire-grate, another by his heating surface, and another by his proportion or form of flues; it matters not which is the favorite view (one may be adopted with less injury to the purchaser than another); nothing short of an impartial consideration of each and *all* of the requirements in generating steam can meet the difficulties of the case.

If such impartial consideration was the general rule, there would be no occasion for the present remarks.

The history of the locomotive boiler clearly shows how little previous design has had to do with its present efficiency; the necessity of using high pressure steam, and the difficulty of condensing, led the way to the blast; and it must be admitted that, of all kinds of boilers, the locomotive is the most scientific and the most economical, if allowance be made for the peculiar requirements connected with its use.

Notwithstanding the temperature of the smoke-box is often 1000°, with a combustion of from 60 to 120 lbs. of fuel per square foot of fire-grate per hour, a larger amount of water is evaporated by a given weight of fuel than in the majority of land or marine boilers. The rapid combustion is more perfect—almost every portion of the boiler is protected by non-conducting materials—less than 7 ft. of heating surface is sufficient to evaporate a cubic foot of water—and 1 lb. of Welch coal will evaporate 8½ to 9 lbs. of water: nevertheless, there is much unnecessary waste of fuel in the high temperature of the escaping gases (although they are not, *comparatively*, so high when the temperature in the furnace is considered), and in supplying the feed-water at a low temperature. With the introduction of coal as fuel, modifications may be required in the furnace and tubes; and there is much reason to believe, from comparative experiments, that *crowded* tubes do not allow the steam to escape to the steam space as quickly as it is generated.

We may confidently look to a considerable increase of economy and efficiency in the locomotive boiler, even though now for weight, space, cost, and economy of fuel, it must be placed at the top of the list, and certainly deserves the least criticism.

The duty and economy of steam boilers are mainly dependent on the rate of combustion, the ratio between the heating surface and the fire-grate, and the ratio between the heating surface and the consumption of fuel per hour, thus:—

RATE OF COMBUSTION.

| | |
|---|---|
| Cornish boilers burn per square foot of fire-grate, | 4 lbs. |
| Ordinary land boilers, | 12 " |
| Marine boilers, | 18 " |
| Locomotive boilers, | 100 " |

RATIO BETWEEN HEATING SURFACE AND FIRE-GRATE.

| | |
|---|---|
| Ordinary land boilers, | 12 to 1. |
| Marine boilers, | 27 to 1. |
| Cornish boilers, | 36 to 1. |
| Locomotive boilers, | 75 to 1. |

RATIO OF HEATING SURFACE TO RATE OF COMBUSTION.

| | |
|---|---|
| Cornish boilers, | 9·0 to 1. |
| Marine boilers, | 1·5 to 1. |
| Ordinary land boilers, | 1·0 to 1. |
| Locomotive boilers, | 0·75 to 1. |

The preceding figures are only approximate, but they represent the particular features of each class, and if we were to tabulate them according to the *economy* generally realized, the Cornish boiler would stand first, the marine second, and the common land boiler third; for obvious reasons, the locomotive boiler cannot be fairly classed with the other three.

If we take as a standard the *rate of evaporation* for a given quantity of heating surface, we must place the common land boiler first, the marine boiler second, and the Cornish boiler third; and here again the locomotive boiler must be omitted as an exceptional construction.

In such general remarks and statements as the preceding, it is not necessary that they should represent the experience of all our readers —they are based on actual practice, and suffice to illustrate the subject under discussion, and point out the connexion always existing between sound principles and successful practical engineering.

It is assumed, as generally acknowledged, that from 30 to 60 per cent. of fuel is wasted in generating steam, and that a considerable amount of this waste ought to be, and can be, avoided; and although we do not dictate the exact means for accomplishing this, we can easily trace out, in the majority of cases, the direction of the improvement required.

Boilers made and used in districts where fuel is cheaply obtained have never been remarkable for their economical performances, nor are the engineers in those districts famed for great anxiety to introduce improvements for economizing fuel; it cannot be expected, and we are not surprised to know that land boilers in coal districts only evaporate 6 lbs. of water at 212° by 1 lb. of fuel.

With wagon or plain cylindrical boilers, that form such a large proportion of those now in use on land, economy of fuel is simply a question of size to produce a given weight of steam, it becomes almost entirely a question of capital; an increased ratio between the heating surface and the fire-grate is in this case the desideratum; the furnace flues and chimney being well proportioned, and every effort made to check radiation.

In the Cornish boiler, where the furnace is *within* the inside tube or tubes, that temperature in combustion which is so essential to its perfection is not easily obtained; hence the difficulty that arises in attempts to consume the smoke in such furnaces; an increase of duty and economy would ensue from placing the furnace *under* the boiler, and returning the heated gases through two smaller tubes—a plan that has been often tried with universal success; it allows ample space in the furnace, insures perfect combustion, and has also other mechanical advantages.

In other descriptions of land boilers, where additional heating surface is introduced within the main shell, if well proportioned, they are

generally more economical than the Cornish boilers with the same ratio of heating surface to fire-grate, and with the same rate of combustion.

There can be no doubt that, for land purposes, a boiler with internal flues, capacious furnace, a greatly increased ratio between the heating surface and the fire-grate, and a rate of combustion above that in general practice, is the cheapest, the most effective, and the most economical.

There can be—indeed there is—no difficulty with such boilers in realizing an increased economy to the extent of 30 per cent., and in obtaining a greater effect in a given time from a ton weight of boiler.

We must defer to next month our investigation of the present state and future prospects of steam generation in marine boilers—the most important branch of our subject. If there are reasons why we should economize fuel on shore, how much stronger do they become when it is a question of freight as well as of fuel saved.

In addition to the purely economical value of steam boilers, we shall hereafter have to consider their mechanical construction, especially as affected by the introduction of steam of high pressure.

In concluding these remarks, we would impress on our readers that our only wish is to direct attention generally to present defects in the Steam Engineering of 1859, and to point out to young engineers those paths of improvement where their energies and talents will be productive of real benefit to their profession, and to the world at large.

(To be Continued.)

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*Under Sunk Foundations.** By C. I. SPENCER, Resident Engineer of Chunar Division, East India Railway.

The following remarks on the subject of well-sinking in bridge foundations embody the experience gained in sinking the foundation wells of a bridge over the Jurgoonullah, a hill stream which runs into the Ganges a few miles below Chunar.

Such knowledge being derived from one job is necessarily partial and limited, and is only offered as a contribution towards the general stock of information wanted on a very interesting subject; and I shall be thankful to any one engaged on similar works who will correct, from more complete information, any erroneous conclusions I may have come to, or raise a discussion on any doubtful point.

The Jurgoo well-sinking, which was commenced in October, 1857, has just been brought to a successful termination, and what few mistakes were made at starting in points on which we had not the light of experience to guide us, have not involved any serious ill consequences, and are now fruitful of instruction.

In deciding upon the use of under sunk foundations in preference to piles, coffer dams, or any other expedient, it is necessary to take into consideration the form and material of the bed of the river to be bridged, the floods to which it is subject, and their tendency to scour to any given depth.

In these particulars the Jurgoonullah is so circumstanced, as to ren-

* From the Lond. Civ. Eng. and Arch. Journal, Sept, 1859.

der it unsafe or difficult to use any other kind of foundation than the one adopted. The bed at the point bridged, consists almost entirely of sand, gravel, and other loose drift material, to a depth of about 20 feet, below which occurs a stratum of pure white sand of unknown thickness, which extends under the strong kunkury clay at the banks of the nullah, and has evidently never been disturbed by the action of the stream.

The stream itself is a mere hill-torrent, rising above 20 feet in two or three hours and falling again as rapidly; in the dry weather it does not rise above its bed, but stands in pools in the sand. Besides the hill floods, the nullah is subject to overflow from the backwater of the Ganges, and the alternating and sometimes combined action of these floods gives rise to alternate scourings and fillings of a kind very difficult to foresee or provide for.

The only certain principle therefore upon which it was possible to proceed was to assume that what the water had done it would do again, that the scour would reach on some future occasion the depth it had reached before, and having ascertained this limit, to sink the wells to what might be considered a safe distance below it, and there leave them in the white sand which there appeared no hope of getting to the bottom of.

In such a situation piles would have been useless, the stuff would have been washed out from between them, and the bridge been left standing on the naked sticks; sheet piling could never have been driven deep enough to defend them from the scour, and to have sunk coffer dams 30 feet into the bed, dredged out the stuff, and filled the bottom with concrete, might have been a safe plan, but would certainly have been a tedious and expensive one.

Having then once determined on the use of wells, the next thing was to find out the proper dimensions and arrangement, as well as the best form of curb and mode of attaching it to the masonry. In all these particulars, the one great object to be attained is to make a well which shall *sink*, for if by any accident or defect in design or construction, one of the wells should stick half way and obstinately refuse to budge an inch, a contingency which sometimes happens, it is next to impossible to get it out again, and the engineer may be placed in the unpleasant position of having to alter his design and begin foundations in a new place.

Before considering the causes which tend to impede the descent of wells, I shall describe the different modes adopted for sinking them.

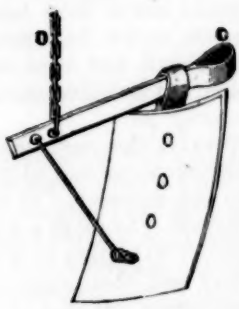
In every case the first step is to lay the curb on the surface, as low down as possible, and build the wall to a height above it, equal to somewhat less than its own diameter; the sand and stuff is then cleaned out from the interior, and leaves a hollow into which the well sinks. For the first few feet the men can stand in the water and lift the sand out easily enough, but as the water gets deeper, it becomes necessary either to get rid of the water or to contrive some way of working under water.

The first plan, viz: getting out the water, is, when feasible, by far the most speedy and satisfactory, and it may sometimes be advisable

even to go to the expense of a steam engine to work the wells dry. Where this cannot be done, or where the quantity of water is not so great as to require it, the pumping may be done more awkwardly, but more cheaply, by means of buckets and pulleys worked by coolies. A large amount of the Jurgoo well-sinking was done by these means: two or three leathern buckets or rather bags (*mhotes*), each pulled by eight or ten coolies, were let down each well, and with European superintendence and energetic driving, it was found possible in most cases to lower the water in three or four hours sufficiently for the men to stand in it.

2. When the water cannot be got low enough, or even while it is in process of lowering, the stuff may be got out by means of divers, who go down with a small iron plate, with which they shovel the sand into a basket, which when full is drawn up by a couple of women. The divers stay about 15 seconds under water, and will often fill a basket at one dive, but they soon get tired, and it was found necessary to have four relays of them every day, and to pay each of them four annas per diem, or about three times the pay of an ordinary coolie.

3. The jham is used in cases where the water cannot be lowered and is too deep for divers. It consists of a plate of iron about 2 feet square; at the upper end is a collar c, into which is inserted the end of a pole which is about 4 or 5 feet longer than the depth of the well: the jham with the pole fixed is dropped with some force on to the bottom of the well, and the pole is moved about by the men above, so as to work the edge of the iron as deep as possible into the soil. The chain o is then drawn up by means of a windlass, the collar c disengages itself from the spindle end of the pole, the lower end of the shovel is lifted up, and the jham plate hangs like a scale pan, with a certain, or rather a very uncertain, quantity of stuff in it. This has to be lifted slowly and carefully, so that the water may not wash it away. When it reaches the mouth of the well the contents are drawn out, the pole fixed, and the whole contrivance dropped once more to the bottom.




The jham works sometimes very well in sand and loose material, and I have seen them at the Jumna coming up with about a cubic foot of stuff on them; but it is at best a capricious thing, and often comes up empty or with the merest spoonful of earth on it, especially when used to get up hard clay or kunkury sand. I do not know who was the inventor of this singular instrument, but he must have been in India a long time, and have got the idea of a codalee irretrievably fixed in his mind. It is, however, as far as I know, the best instrument that has yet been invented for the purpose. I have seen dredges tried, but never heard of one being applied successfully. There was one tried at the Jurgoo, but the buckets had a trick of getting upside down, or hind part before, or any way but the right one. They have,

I believe, been since tried at the Jumna, and it would be interesting to know how far they have succeeded. The one used at the Jurgoo consisted of a set of small scoops or buckets fastened at intervals of about 2 feet along a couple of ordinary chains, which passed round a couple of rollers at top and bottom of a square frame inside the well; one of these chains was constantly gaining on the other, and the buckets getting tilted up at one side. To obviate this I would propose making each pair of links the full length of the distance between two successive buckets, and making the roller of a polygonal form, each side being equal to the length of one link.

I do not, however, think that a dredge is the thing required for well-sinking. It is too large and too heavy, and takes too much time in fixing and lengthening, and is too expensive in proportion to the total cost of sinking. What is wanted is some machine that can be worked like a jham at the end of a pole, but which will be more certain in its action and less liable to come up empty—something which can be lifted out of one well into another easily and readily without carpenters, and not keep all your coolies waiting for more than half an hour at most.

I submit the question to the ingenious among your correspondents: if any of them can solve it in a good, practical, practicable form, he will supply a great desideratum in Indian public works.

Such are the chief methods which have been employed to sink the Jurgoo wells.

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### *Mann's Patent Safety Apparatus for Steam Boilers.**

The accompanying wood cut exhibits a front elevation of a very simple and ingenious apparatus invented by Mr. Mann, the engineer of the City of London Gas Works.

The contrivance is intended to record the proper attention or neglect to the testing the ordinary water and steam-cocks of boilers, and accurate register of the steam-pressure within the boiler may be secured by the same instrument. It is applied very readily to any steam-boiler, and in any convenient position.

The following is a description of the apparatus:—

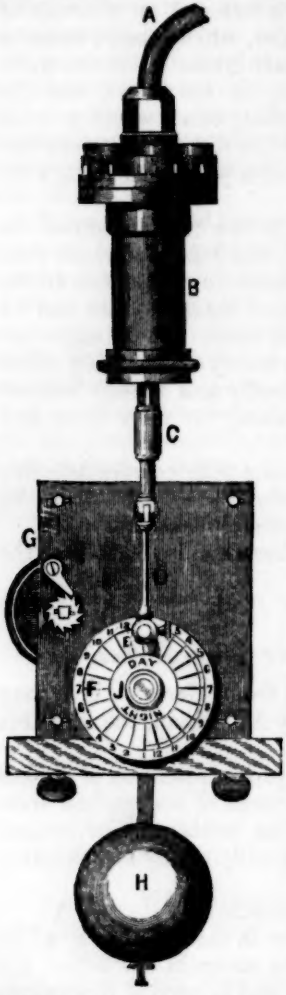
The pipe A admits steam to a spring piston in the cylinder B, which descends in proportion to the pressure of the steam in the boiler; the arm C is fixed to the end of the piston-rod, and is carried downwards with it; the nature of the arrangement will have an *upward motion*, hence, as the pressure of the steam increases, the pencil E, in the pencil bar O, will be drawn up to one of the circular lines of pressure on the diagram paper or card.

E is the pencil, which can be removed in a moment, if required, by simply throwing up the lever, in which condition it will remain, until the pencil is replaced, when it is again brought down and left to keep the pencil up to its work, by a gentle pressure received from the spring at its upper end.

The eight day clock, of which the barrel, G, is seen, carries round

* From the Lond. Artizan, August, 1859.

once in 24 hours, a metal disc, to which is fixed by the thumb-screw, J, the paper or card disc having thereon circles corresponding to the steam pressure from zero to 40 lbs. (or higher if required), and radial lines equal to the twenty-four hours of the day.




The apparatus works in the following manner:—Upon the gauge-cocks being tried at the intervals of time during the day or night for which the circular card has been divided, that shown in the accompanying diagram having divisions of one hour, although there may, in practice, be two, four, or more divisions in the hour. The piston is caused by the pressure of steam above it (admitted from a suitable pipe connected with the gauge-cocks), to descend, and carry the pencil downward toward the centre of the card, making a radial mark thereon to an extent corresponding with the change of pressure—the time of opening the cock being recorded by the rotation of the card by the clock-work, so that should the attendant not be present and open the cocks at the proper time, the division or line upon which the mark should have been made will have passed the point of the pencil and the line of its course.

This apparatus is both simple and ingenious. It has been used most successfully at the City Gas Works for many months past, and it deserves to be better known and more generally adopted.

We are glad to perceive attention is being called to the want of such apparatus, as will be seen by the following extract from the report of Mr. Longridge, of Manchester:—

"In reference to the boilers which sustained injury, in consequence of deficiency of water, it is mentioned that in one case the explosionwas caused by fracture of the blow-off pipe which, during the night, allowed the water to escape unobserved by the watchman, who continued firing after the boiler was empty. In the other two cases the feed-valves appear not to have been tight, and, on preparing to start in the morning, the water in the boilers was driven back by the increasing pressure of the steam, and the furnace crowns much injured in consequence. Though these boilers were provided with glass tube-gauges and floats, these appear to have received no attention at the time, thus pointing out the necessity of employing other means of safety."

# AMERICAN PATENTS.

## List of American Patents which issued from September 13, to September 27, 1859, (inclusive,) with Exemplifications.

### SEPTEMBER 13.

97. Lamp Chimneys; Elias J. Hale, Foxcroft, Maine.

Claim—Contracting the chimney above the flame, and admitting at or near the same point a current of air, in the manner set forth.

98. Exhaust Pipe for Steam Engines; Robert Hale, Roxbury, Massachusetts.

Claim—An exhaust pipe, constructed as described, and having an opening and a steam pipe, in combination with a lip, operating in the manner set forth.

99. Excavator; William Hamilton, St. Catharine, Missouri.

Claim—1st, In combination with an excavator frame, constructed as described, having the side timbers braced in front only, I claim four wheels, when arranged in relation to the said frame, so that a common cart may either be backed between the hind wheels, or pushed over said wheels and frame, under the excavator, when the same is hoisted to be discharged. 2d, The combination of an excavator with a frame, having the rear ends of each of the side timbers bifurcated for the reception of the wheel, the same being arranged to turn on a pin or journal, extending transversely through the two forks. 3d, The peculiar arrangement of hanging the excavator to the frame by means of arms, the same being so pivoted at the ends respectively to the excavator and side timbers, as that they shall be exposed to a tensile strain in the draft line, or thereabout, during the excavating operation of the machine.

100. Barrel Syringes; Stephen P. Hart, Boston, Massachusetts.

Claim—The spring, as applied to the syringe, operating in the manner set forth.

101. Churn; Malachi B. Hassler, Columbia City, Indiana.

Claim—The arrangement of the hinged curved leaf, in combination with the wings, arranged as described.

102. Construction of Segmental Circular Saws; R. K. Hawley, Baltimore, Maryland.

Claim—A segmental veneer saw, the blades of which are formed, hung, and clamped, in the manner described.

103. Grinding the Teeth of Mowers and Reapers; David Hinman, Berea, Ohio.

Claim—The circular grooves on the faces of the grindstone in connexion with the standards and holder, arranged and operating in the manner specified.

104. Mangle; W. W. Hollman, Eddyville, Kentucky.

Claim—The combination of the levers with one of the rolls and balancing lever, as set forth.

105. Mode of Manufacturing Telegraph Cables; W. H. Horstman, Brooklyn, New York.

Claim—Constructing the cable by the apparatus, consisting of the reservoir, wrapping apparatus, &c., or their equivalents, as specified. Also, the final reservoir for coating a telegraphic cable after it has passed all the other apparatus, and before it has entered the water or ground, constructed and applied as specified. Also, the manufacturing of the cable, in the manner described, at the time it is laid, so as to perfect it and at once launch it into the place where it is to remain, whereby I avoid all the chances for injury and imperfections arising therefrom, growing out of stowing and handling the cable after it has been made, as heretofore has been done.

106. Harvesting Machines; A. H. Inskeep, Middleburg, Ohio.

Claim—1st, The arrangement of the revolving, spiral, cone-shaped cutter or gatherer with the base of the cone in front, to gather up and draw the grain back to either stationary or reciprocating cutters, as described. 2d, The combination of the spirally-formed gatherer or cutter, arranged as described, with the divider, guards, and stationary cutters.

107. Cultivators; W. D. Johnson, Raleigh, North Carolina.

Claim—The bars, curved so as to form handles at one end, and having horizontal oblique positions to form the body of the frame, the draft bar, and guide or retaining bar, the front ends of the bars being connected or secured together by the collar or loop, in combination with the double scraper.

108. Seeding Machines; W. D. Johnson, Raleigh, North Carolina.

Claim—The arrangement of two distributing slides with the projections on the wheels, and two or more compartments in the hopper, inclined tube, inclined draft bar, and adjustable roller standard.

109. Boilers for Making Paper Pulp from Wood; Morris L. Keen, Rogers' Ford, Pennsylvania.

Claim—A boiler for boiling, under pressure, wood and ligneous materials for making paper pulp, constructed with an expansion chamber, stirrers, and discharge valve or cock, arranged in the manner stated.

110. Cultivators; Asa M. Keith, Kosciusko, Mississippi.

Claim—The arrangement of the double scraper, the hoe drum, and the hillers or coverers, in their relation to each other and to the parts of the frame to which they are attached, as set forth.

111. Movable Tops for Carriages; John C. Kimball, New Haven, Connecticut.

Claim—So constructing the standards or supports of a standing carriage top, and attaching them by means of screws, that the top and standards or supports may be readily removed, when the whole is constructed and connected substantially as described. Also, the combination of the standards with the body, when the standards are secured, being screwed into the upper ends of the studs, and the whole is constructed as described.

112. Locomotive Lamps; Nelson J. Knapp, Chicago, Illinois.

Claim—The combination of the ellipsoidal and paraboloidal reflectors and burner, arranged as set forth.

13. MACHINE FOR ARRANGING PEGS; Jesse Ladd, Holderness, New Hampshire.

Claim—A machine or combination, consisting of the following devices, or their mechanical equivalents, viz:—1, The grooved cylinder, furnished with a hopper or other proper means of supplying it with pegs. 2, The guiding receiver. 3, One or more advancers, and the operative mechanism thereof. 4, A device or mechanism for discharging from the guiding receiver the refuse pegs. 5, The springs or devices for preventing the discharge of the pegs from the guiding receiver, when they may be disposed therein with their butts in advance of their points. 6, The receiving spout. 7, The peg-carrier; and 8, Mechanism for advancing the pegs through the said carrier. Also, in combination with the said machine, or its hopper and grooved cylinder, an agitator, or means of shaking or agitating the mass of pegs in the hopper, or its conductor. Also, in combination with the said machine or its receiving spout, the serrated bar, operated as described, or mechanism for insuring the descent of the pegs within the receiving spout. Also, in combination with the said machine or with the receiving spout and peg-carrier thereof, the device or part, U, made to operate in manner and by means specified. Also, in combination with the said machine or the receiving spout thereof, the door and its operative mechanism, whereby the surplus pegs may be discharged from the spout after it may become sufficiently supplied with pegs. Also, in combination with the said machine or its spout, the finger, or equivalent, to be operated in manner and by means as described.

114. BOARD MEASURER; Augustus Lafever, Battlecreek, Michigan.

Claim—1st, The employment or use of the cone gears and sliding pinions, in connexion with an endless toothed or serrated chain fitted within a suitable case, arranged with gearing and indexes, and with or without the arm and lever. 2d, The arrangement of the yielding frames with the pinion and cone gear, respectively attached to levers and racks.

115. DUMPING CART; John S. Lash, Carlisle, Pennsylvania.

Claim—The employment or use of the curved or segment rack attached to the rod and provided with the ledge, the pinion and hooks, arranged as set forth. Also, the rod provided with the spring, and connected to the sliding or pressure bar provided with the arm, the above parts being applied to the cart, and arranged to operate as set forth.

116. CORN PLANTERS; William Lees, Germantown, Ohio.

Claim—The cylinders, in combination with the hoppers with reference to the feed bar, arranged to operate as set forth.

117. PIANO-FORTES; Ferdinand C. Lighte, City of New York.

Claim—1st, The crystal reverberator of glass, or other material, applied below or at the back of the sound-board, in combination with openings therein, as described. 2d, The insulators, applied between the iron frame or plate, and the rest plank and wooden blocking of the instrument, in such manner that the said frame or plate will bear upon the plank and blocking only at few points, as described.

118. TOBACCO PRESSES; George Lindsey and Wm. Cameron, Petersburgh, Virginia.

Claim—A portable hydraulic jack, or other powerful press, so constructed as to be readily applied to an ordinary or to a series of ordinary screw presses, for the purpose described, and adjustable as to height on the truck on which it rests, in combination with the railroad track, E, at right angles with the track, B, when said press is used for increasing the pressure of the screw press and converting it into a retaining press, as described.

119. LOCK AND DETECTOR; John H. Lyon, City of New York.

Claim—Combining with a padlock, or any lock provided with a shackle, a supplemental shackle, arranged with a lead or soft metal tube, so as to be temporarily secured thereby to the lock case, and admitting of being released only by the severing of the said tube, which thereby serves as a detector. Also, forming the lock case of two parts, with a division plate between, whereby the construction of the lock is rendered extremely simple, and the invention enabled to be carried out or produced at a moderate cost.

120. STEERING APPARATUS FOR BARGES IN RIVERS; Murdock Lytle, Alleghany, Pennsylvania.

Claim—The application of a wheel to the bow of a barge, so that said wheel shall revolve at right angles to the direction of the barge, in combination with an apparatus for operating said wheel by the power of the propelling boat.

121. SEEDING MACHINES; Jacob Maize, Wooster, Ohio.

Claim—The adjustable cultivators provided with the arms, guides, and the adjustable jointed harrow, arranged as described, and acting conjointly with the seeding apparatus, in the manner set forth.

122. DOVETAILING MACHINE; W. A. McDonald, Mott Haven, New York.

Claim—1st, The employment or use of spiral saw-cutters attached to the rotating heads connected by gearing. 2d, In combination with the cutters, the adjustable platform. 3d, The combination of the cutters, platform, and gauge, operated by the screw, for the purpose set forth.

123. CULTIVATORS; Edmund and Benjamin Miller, Rising Sun, Indiana.

Claim—The combined arrangement of the guard, elevated wing, curved horizontally in two directions, adjusting shank, and bracket, operating in connexion with a shovel plough, in the manner set forth.

124. SHINGLE MACHINE; Henry Miller, Grafton, Virginia.

Claim—The manner of tilting the bed, by means of the adjustable wheel on shaft, actuated by the ratchet also on said shaft, the pawl on the framing, spring attached to the carriage, and spring attached to the framing, and acting on the bed, the whole being arranged as set forth. Also, the arrangement of the bed and rods attached to the framing, as shown, to admit of the vertical adjustment of the bed, for the purpose of graduating the thickness of the shingles.

125. COTTON SCRAPERS; Jonathan H. Mitchell, Germantown, Tennessee.

Claim—1st, The combination and arrangement of the beam, chair, mould-board, and share, operating, as set forth. 2d, The adjustable and changeable share, arranged and operating as set forth.

126. CORN PLANTERS; William Morrison, Carlisle, Pennsylvania.

Claim—A corn planter, constructed with the mould-boards, adjustable cutters or coverers, hopper, slides, and clearers.

127. PLOUGHS; William O'Neill, Pine Level, Alabama.

Claim—The lapping land-sides of the ploughs and the bar, attached to the beam, as specified, in combination with the bolts, nuts, and braces described, whereby they may be formed at pleasure into a double or hill-side plough.

128. Ploughs; **William O'Neill, Pine Level, Alabama.**

Claim—The arrangement of the adjustable mould-boards, attached to the share by bolts, and constructed as described, with braces, stock, and share, and point.

129. Lamps; **George T. Parkhurst, Baltimore, Maryland.**

Claim—The flattened air tubes, bent at right or other convenient angles, with a slit or opening at the outer angles, in combination with flat wick tubes, and the combination of the above parts with the cap or dome, made or operating as described.

130. Carriage Springs; **Stephen B. Peet, City of New York.**

Claim—A compound spring, composed of a combination of an elliptic leaf or leaves and a volute coil.

131. Sausage-stuffer; **John G. Perry, Kingston, Rhode Island.**

Claim—Combining the cylinders, having a spiral cavity or cavities, with the follower, as described.

132. Horse Rakes; **Orris Pier, Ludlow, Vermont.**

Claim—The combination of the adjustable bar, I, lever, bar, E, rods, rake, strap, and seat, as described.

133. Boilers and Steamers; **Daniel R. Prindle, Bethany, New York.**

Claim—The so turning or forming the flanch of the upper section that it will contain water to prevent the fire from burning the packing beneath the flanches.

134. Seeding Machines; **S. G. Randall, New Braintree, Massachusetts.**

Claim—The arrangement and combination of the series of plate wheels, seed boxes, and horizontal bar, so that as the bar is drawn along, the plate wheels shall assume an oblique position.

135. Skiving Machines; **J. A. Safford, Winchester, Mass., and John W. Chase, North Weare, N. H.**

Claim—1st, Hanging the gauge roll in vibrating frames, in combination with the spring and retaining spring-catch, and adjustable stops, arranged as specified. 2d, The over-lapping knife, in combination with the adjustable spring apron, arranged as specified.

136. Carriage-tops; **Francis C. Shaffer, Brooklyn, New York.**

Claim—The arrangement and combination with the curtains, of the hooks, guides, and supporters, so that the curtains may be kept stretched, and be readily lowered or raised and secured overhead, within the carriage at any desired point.

137. Spirit Level; **Thaddeus S. Scoville, Rochester, New York.**

Claim—Employing a single transparent cell or cistern of spirits, or other fluids, in combination with the scale and rectangular stock, in such a manner that the surface line of the liquid shall indicate both the horizontal and perpendicular, with the intermediate degrees.

138. Seeding Machines; **Harvey Sloan, Franklin, Indiana.**

Claim—1st, The arrangement of shanks, drag-bars, levers, bar, rest, and support, combined and operating as specified. 2d, In connexion with the subject of the first claim, the arrangement of rollers, seed boxes, and slides, constructed as specified.

139. Railroad Car Seats; **C. A. Smith, Piermont, New York.**

Claim—1st, The arrangement of the back and bottom of a car seat, so that when the seat is adjusted to an inclined position both parts to move together on the same pivot on which the back moves, independent of the bottom, when the seat is reversed. 2d, The spring catch, notched arc, bottom, and back, arranged as described.

140. Cotton Seed Planters; **P. M. Smith and T. T. Collier, Lavernia, Texas.**

Claim—The arrangement and combination of the wheels, axle, crank, pulley, slide, agitator, fender-bar, plough-share, and scraper, as described.

141. Thimble; **James C. R. Steirly, Brooklyn, New York.**

Claim—The combination of the thimble and cutter, in the manner set forth.

142. Cooking Stoves; **David Stuart, Philadelphia, Pennsylvania.**

Claim—Combining with the hollow cross-piece the distributor, arranged as set forth.

143. Folding Chair; **J. H. Swan, City of New York.**

Claim—1st, The arrangement of the back, seat, and arms, so that the back and seat, when occupied, will be nearly counterpoised, and the arms moved with the seat and back. 2d, In combination with the back, seat, and arms, the curved legs, arranged so as to admit of being completely folded.

144. Churn; **James Taylor, Rushville, Illinois.**

Claim—The peculiar construction and arrangement of perforated brakes and auxiliary reflectors, in combination with a dasher, having its blades flattened out gradually from near the shaft to their ends.

145. Machinery for Forming Hat Bodies; **James S. Taylor, Danbury, Connecticut.**

Claim—The combination of the two perforated cones and exhaust, with one picker and feed arrangement, so arranged that the current of impelled fur is alternately shifted from the tip of one cone across on to the tip of the other, in such a manner as to give the required proportions in forming a perfect hat body.

146. Washing Machine; **George W. Tolhurst, Liverpool, Ohio.**

Claim—The inside bottom box constructed air-tight, so that when the pressure of the upper rubber is removed it will float, and expose the clothes to be handled.

147. Seeding Machines; **M. L. Tourtelett, Neshonoc, Wisconsin.**

Claim—The combination and arrangement of the levers, connected by the traverse rod, the cam, and the slides, for joint operation.

148. Hygrometer; **Louis S. Ullmann, Nashville, Tennessee.**

Claim—The combination of the capsule and naturally spiral tail-like appendage of either of the plants specified, with an index or dial, or their equivalents, substantially as described, to constitute a hygrometer.

149. Machine for Weighing Grain, &c.; **John Van Horne, Magnolia, Illinois.**

Claim—Weighing, by means of a round ball or self-acting weigher, operating in a concave beam, or

balance and blocks, and spiral springs, working in the bottom of the beam by means of the grooves, so as to weigh different weights or drafts, H, and board, combined, for the purposes set forth.

150. MACHINES FOR RAKING AND LOADING HAY; Thomas J. Wallace, Cameron, Illinois.

Claim—1st, A hay-raker and loader, arranged and combined together as described. 2d, The combination of the inclined part, A, with its pivot, with the part, A, of the main frame and slot, as set forth.

151. CARPENTERS' RULE; Hamlin Whitmore and David M. Smith, Springfield, Vermont.

Claim—The spiral springs applied to the pintle of the joint, in combination with the elastic bearings of the plates provided with notches and projections, as set forth.

152. CORN PLANTERS; Charles Whitaker, Davenport, Iowa.

Claim—The arrangement of the seed boxes or receptacles, slides, stationary plates, and movable plate, with the arms and weights attached.

153. GRATES; J. S. Williams, St. Louis, Missouri.

Claim—The combination of the stove grate having register plates and valves which admit unheated air from the room at all times, through the bottom of said plates, but control the flow of heated air into the room with the ordinary fire-place, when the latter is separated from the flue above by a simple fire-board.

154. PLOUGHS; W. B. Williams, Warrenton, North Carolina.

Claim—1st, The combination of screw-bolts, nut in beam, standard, cuff, and slotted brace, to regulate the depth of ploughing. 2d, And in combination with the above, the curved arm for collecting weeds.

155. PLOUGHS; W. B. Williams, Warrenton, North Carolina.

Claim—The combination of standards, plate, and oblique wings, with share.

156. CONVERTING ROTARY INTO RECIPROCATING RECTILINEAR MOTION; Albert Broughton, Malone, New York.

Claim—The combination of the divided journal-box, containing two bearings, and closed by springs, G G, and the spring, I, or toothed plate, with the vibrating pinion shaft.

157. COVER FOR STOVE PLATES; J. H. Gould, Alliance, Assignor to self and E. A. Hartshorn, Mount Union, Ohio.

Claim—The self-erecting handle, in combination with weights, arranged essentially as set forth.

158. BRICK MACHINES; James A. Hamer, Reading, and Norris Maris, Kimberton, Pennsylvania.

Claim—1st, The combination of the blades and rods with the valves and spiral, arranged as set forth. 2d, The combination of the adjustable cover with spiral and trough, for the purpose of relieving or increasing the pressure upon the clay in the moulds. 3d, The combination of the hinged smoothing-piece with the hinged vertically reciprocating piece, as set forth. 4th, Providing the hinged smoothing-piece with the slot and tube, as set forth.

159. CALENDAR CLOCKS; S. P. La Due, Assignor to Thomas S. La Due, Rockford, Iowa.

Claim—1st, The arrangement and combination of the wheels and the ring, the faces of which are marked with the proper figures and letters, so that they indicate the seconds, the minutes, the hours, and the days of the week and month. 2d, Arranging the wheel in such a manner that it serves the double purpose of actuating the bell-hammer, and to indicate the hours of the day. 3d, Placing the figures and dials on the faces of the driving wheels to indicate the seconds and minutes by a continuous motion; also, to indicate the hours by a continuous or intermittent motion.

160. STRAW CUTTERS; Joseph B. Okey, Assignor to self and Wm. H. Hendrick, Indianapolis, Indiana.

Claim—1st, The combination of sliding bar, constructed as set forth, with yoke and vibrating bottom. 2d, The combination of cams with lever, constructed and used as described.

161. BREECH-LOADING FIRE ARMS; Joseph Rider, Newark, Ohio, Assignor to self and E. Remington & Sons, Ilion, New York.

Claim—The combination of the movable breech-pin and the cap tube applied to a pistol, as described. And, in combination with a hammer of the form described, I claim the arrangement of the main spring and trigger, relatively to each other, to the hammer, and to the stock and barrel, as described.

162. SEWING MACHINES; Joseph C. Silvey, New Orleans, Assignor to Thomas J. Dobyns, St. Helena Parish, Louisiana.

Claim—1st, Operating the needle-arm by means of a grooved eccentric and a pin on the needle-arm, arranged in the manner described. 2d, The construction or arrangement of the portion of the feed-plate or table through which the needle and the feeding-dog work, to form an inclined plane relatively to the direction of the movement of the feeding-dog. 3d, The combination of springs, applied in the manner described, to effect the tightening of the stitch, and otherwise control the thread between the perforating needle and its spool, by the automatic operation explained.

163. APPARATUS FOR FEEDING PEGS; Seth D. Tripp, Assignor to self and Luther Hill, Stoneham, Mass.

Claim—1st, Winding up the blank or strip of pegs with the ribbon, so that as the ribbon is wound off by the movement of the machine, the blank will be fed up in the manner set forth. 2d, Hanging the spool on a vibrating arm, so that the spool and trough may follow the motions of the swinging gate or part of the pegging machine, to which the trough is attached.

164. SCALES; Andrew Turnbull, West Meriden, Assignor to self and James B. Frary, Meriden, Connecticut.

Claim—1st, The combination of the beam lever with scoop platform attached, with the spring, rack, adjustable or fixed pinion, with index or indexes attached to its arbor, and traversing over a graduated plate or plates. 2d, Attaching or suspending loosely the rack to the beam lever, by means of a pivot, and having a spring acting on said rack in order to keep the same in gear with the pinion. 3d, Attaching the lower end of the spring to the traverse bar by means of the screw and nut, in order to regulate the tension of the spring and preserve its uniformity. 4th, In combination with the beam lever, spring, and indexes, connected with the beam lever, the stop, on the arbor, for the purposes specified.

165. CLOTHES DRYER; O. H. Waters, Baltimore, Maryland, Assignor to Alfred Hunter, Washington City, D. C.

Claim—The combination and arrangement of the adjustable grooved post, its radial arms, and box, H, with box, A, cylinder, and protector, constructed in the manner set forth.

166. LAMPS; Lewis White, Hartford, Connecticut, Assignor to self and Daniel McLaughlin, City of N. York.

Claim—The application and arrangement of the operating gears, when placed in the manner described. Also, the movable flaps, in the manner described.

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167. PLANETARIUM; Lemuel Allen, Pekin, Illinois.

Claim—The representation of the planets and their orbits suspended on a diametric rod, and capable of rotating on said rod, within a broad belt which represents the zodiac. Also, the arrangement of devices by which the earth may be adjusted to represent its relative position to the sun, and to the plane of its orbit, at any point thereof, in the manner set forth.

168. SLIDE VALVES IN STEAM ENGINES; Astley C. Ancona, Reading, Pennsylvania.

Claim—The corrugated valve seat, in combination with the cavities in the face of the valve, substantially the same as set forth.

169. GRAIN SEPARATORS; P. J. Ankney and Daniel McGreevy, New Lexington, Ohio.

Claim—1st, The oscillating hopper or trough, b, as constructed, in combination with the revolving screen, operating jointly, as described. 2d, The combination of the screen, and trough, and hopper, b, with the adjustable hopper or trough, h, and the spout, with gauge, cut-off, and valve, as described.

170. MORTISING MACHINES; W. R. Axe, Beloit, Wisconsin.

Claim—The gauge plate and slides, in combination with the reciprocating table and adjustable table, arranged in the manner set forth.

171 STEAM ENGINES; Horace Bertholet, Reading, Pennsylvania.

Claim—The peculiar arrangement of the bar in the slotted valve stem, and the connexion of the arms with the cylinder cocks.

172. CHANGEABLE STENCIL; Jonathan Bigelow, Brighton, Massachusetts.

Claim—The character plate formed at its ends, as described, whether the same be swaged at one edge or not. Also, the stencil formed by the combination of said character plates, and a frame or frames or clamps.

173. MANUFACTURE OF THIMBLES; Peter S. Bishop, Smithfield, Rhode Island.

Claim—A thimble made from plated or overlaid metal, either in the common form with fluted sides, or with sides in the form of a regular geometrical figure.

174. WASHING MACHINE; Alpheus Bissell, Berlin, Wisconsin.

Claim—The arrangement of the false bottom, cords, pulleys, platform, and cam chuck, with the frame, provided with corrugated rubbers, with rollers, and with levers, said frame being operated by means of cranks.

175. GRAIN SEPARATORS; J. L. Booth, Cuyahoga Falls, Ohio.

Claim—The inclined zigzag screens, and boxes, and troughs, having a shake motion given them, and used in connexion with the revolving fan and spout.

176. SADDLE-TREES; J. H. Boyd, Baltimore, Maryland.

Claim—The employment of the double head or gullet plates, c and d, when the front head or gullet, d, is connected to the body of the tree by means of springs, in such manner that when the straining web is attached to said head and to the back of the tree, a spring seat will be formed.

177. STEAM-PRESSURE INDICATOR OR ALARM; Samuel W. Brown, Lowell, Massachusetts.

Claim—The arrangement and combination of cylinder, rod, tube, and valve with each other, in the manner described, for indicating or giving the alarm with steam from the same or contiguous chamber.

178. SASH-FASTENER; Morgan Chittenden, Danbury, Connecticut.

Claim—The combination of a T-shaped wedge with a bolt case, having an opening corresponding thereto, whereby the two sashes are uniformly and closely secured together.

179. HYDRAULIC PRESSES; M. H. Clark, Danville, Virginia.

Claim—1st, The arrangement of the water reservoir, force-pump or pumps, main supply pipe, branches, stop-cocks, and a series of hydraulic presses, for united operation. 2d, Arranging a leather packing-ring on a disc which is divided radially into a series of parts, and fitted loosely on a conical extension of the piston, and held in contact with said extension by means of an undivided disc which is suspended loosely so as to have vertical play on a screw or head pin of the piston.

180. APPLE-PARER; Richardson T. Clark, Johnstown, New York.

Claim—The combination and arrangement of the paring-knife, lever, spring, e, cord, clutch drum, and spring, u, with shaft band, and pulleys, and wheels, and apple fork.

181. STOPPERS FOR PRESERVE CANS; V. P. Corbett, Washington City, D. C.

Claim—The arrangement of the plate, screw, conical nut, and disc, composed of two or more sections, when the same are used in connexion with an elastic band or rim.

182. APPARATUS FOR REEFING SAILS; George B. Cornish, City of New York.

Claim—Constructing the slip bands in one piece with four flanches, a a a′ a′, the spaces between a a and a′ a′ serving as slip bands, and the central space between flanches, a a′, serving as a band on which the reef pennant is wound, said flanches serving to prevent any lateral movement of the yard, and also to prevent the reef pennant from coming in contact with, and being injured by, the quarter bands.

183. STEADYING LOGS IN SAW-MILLS; Riley Doty, Cardington, Ohio.

Claim—The employment of the adjustable frames, provided with journal bearings and with rollers, the same being operated in one direction by means of the head and tail blocks, and in the other direction by means of a cord and weight, one of said frames being stationed as described, by a spring provided with a shoulder and an incline plane.

184. LAMPS; John L. Drake, Cincinnati, Ohio.

Claim—The employment or use of the disc applied to the wick tube, and used in connexion with the cap, and arranged relatively with it.

185. DERRICKS; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—The combination of the toggles and right and left screw boom, when the latter has its fulcrum movable with the pulleys, in the manner described.

186. COFFEE-POTS; Oliver T. Eddy, Philadelphia, Pennsylvania.

Claim—The annular cone-shaped deflecting plate resting on the bottom of the pot, and arranged in respect to the tube and perforated plate, as set forth.

187. ELECTRO-MAGNETIC STEAM BOILER GAUGE; Moses G. Farmer, Salem, Massachusetts.

Claim—The combination of an indicator, an electric circuit or circuits, one or more circuit-breakers, with a float, in any manner substantially as described.

188. HORSE POWER MACHINES; L. R. Faught, Atlanta, Georgia.

Claim—The arrangement and combination of a stationary geared rim, movable rim, supporting bar fitted in the pinions, c c, the shaft, g g, provided with pinions, f f, and wheels, and the shaft, f', as set forth.

189. METHOD OF OPERATING CROZING KNIVES; George Finn, Oswego, New York.

Claim—Arranging the cam that works the cutter on the bevel-wheel, so that it will not occupy more space on the arm that carries them than that occupied by said bevel-wheel, for the purpose of simplifying the mechanism and economizing space on said arm, which is necessarily limited in length.

190. RAILROAD CAR SEATS; Eli Wheeler, Elmira, New York.

Claim—1st, The arrangement of box-formed supports, cushions, and cushioned seat backs of a pair of car seats, in the manner specified, whereby when the bottoms of the seats are turned over, to fill up the space between the seats, the bed-clothing contained in the box will be exposed so as to be readily removed, and then, when the backs are turned down to fill the place occupied by the bottoms, the said boxes will be closed up and a continuous bed formed from one back edge to the other of the seat. 2d, The short open stationary partitions, in combination with sliding-panels, which, when elevated, serve as head and foot boards, and allow ventilation under and above the berth during night time, and when lowered during the day time, afford more room to the upper portion of the body of passengers, as they pass through the aisle of the car. 3d, The short sliding-closed blinds, arranged to operate as described, and serve as foot and head-boards, and allowing ventilation above and below the upper berth, in combination with the upper berths and partitions.

191. FURNACE AND APPARATUS FOR TREATING PYRITOUS ORES; John Fretz, Angel, California.

Claim—1st, The hollow stationary cylinder, its revolving worm, and its openings, for the admission of the pyrites, and the introduction of air and discharge of the fumes of sulphur, in combination with the rotating cylinder and its internal ribs, the said stationary and rotating cylinders communicating with each other through a pipe, arranged in respect to the furnace, as set forth. 2d, The system of vertical boxes or chambers communicating with each other, with the steam pipes, the rotating cylinder, and the exit pipe.

192. MACHINERY FOR WARPING YARN; Richard Garsed and Clayton Denn, Philadelphia, Pennsylvania.

Claim—1st, The form of the drop wires, arranged in the manner specified 2d, The cylinder, for the purpose of marking the cuts. 3d, The employment of a register, constructed as specified, for the purpose of registering the number of cuts while the machine is in motion. 4th, The employment of the bar for the purpose of taking the leas, constructed with fingers either on one or both sides. 5th, The combination of the vibrating tube, the stationary hook, the movable hook, and the pin, for the purpose of forming the yarn into links, constructed in the manner described.

193. CHURN; Samuel Gissinger, Alleghany, Pennsylvania.

Claim—The arrangement in the movable frame of the oscillating churns, furnished with dashers and wings, in combination with the revolving shaft armed with wings, arranged as described.

194. GALVANIC BATTERY; Eugene Grenet, Jr., Paris, France.

Claim—1st, The method of agitating the exciting liquid of a galvanic battery by forcing a current of air through it, in the manner set forth. 2d, Arranging and constructing the zinc and charcoal elements, in combination with the exciting fluid, in the manner described, whereby they may be operated, the one by the other. 3d, Forming the charcoal elements by pressing into or on to the surface of plates of lead, when yet in a semi-liquid state, small pieces of charcoal, in the manner described.

195. GAUGE AND BOX FOR CASTING JOURNALS IN SOFT METALS; C. W. Griffith, Dayton, Ohio.

Claim—In combination with a hollow box, a loose removable gauge or centering plate, fitted and fastened to, or held against the box, so as to hold the shaft in its proper position in the box, and at the same time retain or prevent the melted metal that is poured into the hollow box, to form a box around the shaft, from running out.

196. APPARATUS FOR COOLING LIQUIDS; Valentine Hall, City of New York.

Claim—The employment or use of one or more receivers placed within a tank, and connected with the barrel or cask by means of a siphon, and with a pump within or at the outer side of the tank, for the purpose set forth. Also, combining a pump with one or more receivers, connected together and made to communicate with each other by siphons, when said parts are submerged within a tank, and made to communicate with a cask or barrel, by means of a siphon extending over the top of the tank.

197. LAMPS; Halvor Halvorson, Cambridge, Massachusetts.

Claim—1st, The employment or use of the valve in connexion with the wick tubes, for the purpose of regulating the supply of air to the interior of, or between two planes of the wick. 2d, The arrangement of the shaft and their wheels, so that the wheels on one shaft may gear into those on the other, for the purpose of raising and lowering the wicks simultaneously by the turning of one shaft.

198. TROLLING-BAIT FOR CATCHING FISH; Riley Haskell, Painesville, Ohio.

Claim—1st, Constructing the body of an artificial representation of a natural fish in two detached parts, to be used in combination—one portion thereof revolving, and the other remaining fixed or stationary, both portions being on one shaft. 2d, In connexion with my first claim, filling the upper part of said fixed portion with a light substance, and weighting the lower part thereof, for the purpose of keeping the said fixed portion vertical in the water.

199. TAILORS' SHEARS; Rochus Heinsich, Newark, New Jersey.

Claim—Constructing the lower bow with its upper portion widened, and with the projection thereon, so as to form a bearing for the fore-finger within the bow.

200. VARIABLE EXHAUST FOR STEAM ENGINES; W. M. Hurlbert, Northfield, Vermont.

Claim—Applying the slides to operate in elbows or inverted L-shaped nozzles, arranged as described.

[This invention consists in making the upper ends or nozzles of the blast pipes each in the form of an elbow or the inverted letter L, and fitting the regulating slides to the horizontal portions of the elbows, so that both can be adjusted simultaneously by right and left-handed screws on the same shaft, thereby providing very conveniently for the variation of the area of the openings.]

201. STEAM-TRAP; E. T. Jenkins and F. B. Polley, Williamsburgh, New York.

Claim—The round pipe, in combination with the valve seat, valve, ring, opening, and float, arranged in the manner described.

202. BOILERS; Christian Kieffer, Lancaster, Pennsylvania.

Claim—The construction of the extension and perforated steam-pipe, with the extension hot air flue, with the pan, with pipes, I I, and perforated pipe, K, arranged as described.

203. BUNG-HOLE BOREE AND REAMER; Josiah Kirby, Cincinnati, Ohio.

Claim—The conical-shaped stock, when made with a throat cut through from the edge of the bit on one side, to the opposite side of the stock, so that the shavings are made to pass through the stock and out on the opposite side. Also, the combination of the auger bit with reamer, made in the manner described.

204. SEED PLANTERS; Levi L. Lancaster, Rocky Mount, North Carolina.

Claim—The frame, wheels, hopper, cylinder, pockets or depressions, carrying tube, furrow-opener, coulter, leveler, and bottom, arranged as described.

205. THERMOMETRIC REGULATOR FOR HEATING APPARATUS; Lewis W. Leeds and Calvert Vaux, City of New York.

Claim—So applying the vessel, which we have termed the secondary heater, containing the fluid to act upon the piston, or its equivalent, in combination with the primary heater, and so applying the piston, or its equivalent, in combination with said secondary heater and with the regulating valve, that the secondary heater is exposed at the same time to the heating influence of the primary heater and the cooling influence of the incoming cold air, and the fluid contained therein is, by its expansion and contraction, made to control the admission of the steam or other heating agent, and cause the supply of such agent to the heater to vary inversely with variations in the atmospheric temperature.

206. APPROACH-OPENING GATE; Julius S. Lloyd, Philadelphia, Pennsylvania.

Claim—Operating the angular bar by means of the carriage, with its pulleys and guard, in combination with the projecting arm of the rod, and the cranked and weighted rods, and the respective cords or chains, arranged as set forth.

207. WATER INDICATOR FOR STEAM BOILERS; George Lutz, Logan, Ohio.

Claim—1st, Operating auricular and visual alarms, either severally or conjointly, at will, by mechanism such as is described. 2d, The combined index and tripping levers, arranged in the manner set forth. 3d, The combination of the tripping levers, balance lever, and bifurcated rocking lever, as described. 4th, The combination of the catch and dogs, arranged as set forth. 5th, The combination of the bent lever, thumb-screw, and slotted bracket, as described.

208. METHOD OF MAKING SOAP; Augustus Miller, Grafton, Ohio.

Claim—Soap manufactured from the herein-named ingredients and chemicals, when the same are compounded in the manner specified.

209. IRON SPOONS; G. I. Mix, Wallingford, Connecticut.

Claim—1st, The method, substantially as described, of making the handles of iron spoons. 2d, Forming a tongue upon the bowl blank, and a corresponding recess or inlet upon the handle, or vice-versa.

210. CARPET-FASTENER; George G. Noyes, Worcester, Massachusetts.

Claim—The bar, provided with the hooks, knife-edge, and spurs, so that it may be readily secured to, and detached from, the base-board and floor.

211. RAILROAD CHAIRS; W. A. Nugent, Susquehanna Depot, Pennsylvania.

Claim—The shell or body with the cam jars and the chair, arranged as specified.

212. HORIZONTAL WATER-WHEEL; John K. O'Neil, Kingston, New York.

Claim—The arrangement of the guide partitions, cylinders, wheels, and wheels or buckets, in the manner specified.

213. COMPOSITION FOR TANNING; Thomas S. Page, Milan, Ohio.

Claim—A liquor composed of terra japonica, sulphate of alumina and potassa, muriate of soda, nitrate of potash, and sulphate of soda, when combined in the proportions described.

214. BORING AND MORTISING MACHINE; Collin G. Pollock, Cincinnati, Ohio.

Claim—The arrangement and combination of the bar on the arbor, projection on the upright lever, connected with the arbor by the knuckle-joint, and the bevel gear, for joint operation.

215. FEEDING PAPER TO AND FROM PRINTING PRESSES; Charles Potter, Jr., and C. B. Cottrell, Westerly, Rhode Island.

Claim—The securing of the registering points firmly to a fixed portion of the machine, and releasing the paper therefrom at the proper time by elevating the adjacent surface. Also, depositing each sheet face upwards on the pile, by carrying it between a vibrating series of tapes, operated in the manner set forth. Also, the arrangement of the cylinders and the series of tapes, or their respective equivalents, in the vibrating frame, which vibrates on the shaft as a centre, and receives its proper vibratory motion from the hook, or its equivalent, whereby the frame may be readily unhooked and swung out of the way to allow access to the bed of the press without deranging or disturbing any of the mechanism.

216. BURNERS FOR VAPOR LAMPS; William H. Racey, City of New York.

Claim—The burner and curved rods, one or more, in combination with one or more deflecting caps and draft tube, arranged as set forth.

217. INSECT POWDER-BLOWER; Peter Reynard, City of New York, and Victor Varin, Brooklyn, New York.

Claim—The divisions in the powder-chamber to insure the powder being in a position to be acted on by the air blown through the perforated diaphragm. And in combination with said powder-chamber, we claim the india rubber perforated ball, fitted and acting to give the blast of air.

218. THRESHING MACHINES; Joshua Rollman, Sinking Springs, Pennsylvania.

Claim—The application to a threshing machine of one or more independent fan-blowers, which are attached outside of the machine, and in such position as to prevent any dust, arising from the operation of threshing, from reaching the attendant on the machine, arranged in the manner described.

219. Horse Power Machines; Gelston Sanford, Poughkeepsie, New York.

Claim—1st, The combination of the internal toothed wheels and their connected pinions with the hollow standard, arranged in the manner set forth. 2d, The combination of the hollow standard with the shaft and its connected gearing, in the manner described. 3d, The combination of the adjustable bearing or frame with the hollow standard and shaft.

220. Tops for Tables; Nathan Sargent, Charlestown, Massachusetts.

Claim—A panoramic table or table-top, constructed in the manner set forth. Also, the peculiar mechanism whereby the canvass or panoramic cloth is maintained with proper tension upon each of the rollers, however such cloth may vary in thickness or in number of folds upon such rollers.

221. Straw-cutters; Casper Schultze and J. Frederick Schroeder, Covington, Kentucky.

Claim—A cutting box, constructed with adjustable compound knife-wheel, in combination with feeding chute, arranged as described.

222. Machine for Making Sewing Machine Needles; Wm. W. Shipman, New Haven, Connecticut.

Claim—The feeding plier formed by the lever and block, in combination with the punching die, F2, and die, F3 and 21 31, the cutter and clamp formed by J J and I I, the whole in combination as set forth.

223. Electrical Heating Apparatus; George B. Simpson, Washington City, D. C.

Claim—The insulation of the metallic coil or helical electrode, which I call an electro-heater, and the successful generation of heat by passing currents of electricity over a coil or coils of platina, or other metallic wires resting on, and supported by, a non-conducting electrical base, or encased in metallic tubes, or open vessels insulated with any of well known substances non-conducting of electricity, as described.

224. Mode of Constructing Matrices, &c.; John Joseph Charles Smith, Covington, Kentucky.

Claim—The discovery of rendering composition or alloy of copper and tin pliable, and in such a state as to admit of an easy impression of any figure or design on or in metal, whether engraved or produced by means of electrotyping, as a copy of any figure, design, or object, thus yielding a perfect matrix or mould—and this process I further claim, as my invention, in connexion with the manufacturing of types of the alloy of copper and tin, as already described, and which will and shall produce the intended effect.

225. Making Lightning Conductors; Charles Stearns, Lowell, Massachusetts.

Claim—The twisting rollers, constructed as described, in combination with the corrugating rollers, for producing the corrugated twisted copper rod.

226. Horse-rakes; Theodore J. Steffe, Lancaster, Pennsylvania.

Claim—The arrangement and combination of the teeth heads, key, spiral spring attachment, lifters, lever, cleaners, when these several parts have their centre of motion on the axle of the machine. Also, in combination with the above, the foot-brace, hinged at slide and slot, as specified.

227. Hominy Mills; George Strause, Boonsboro', Maryland.

Claim—Giving to the shaft substantially the shape represented, when the said shaft is armed with toothed segments, and is also operated within a tube which is also armed with counteracting segments.

228. Bridges; David H. Van Duzer, Sugar Loaf, New York.

Claim—In combination with the blocks, E F G H I, rods, blocks, c c', and bolts, arranged as shown, the arrangement of the plates, as described.

229. Take-up for Trimming Looms; Samuel Walker, Roxbury, Massachusetts.

Claim—Giving to the take-up roll of a trimming loom a reciprocating motion longitudinally on its axis, for the purpose specified.

230. Photographic Printing Machine; Charles Fontayne, Cincinnati, Ohio.

Claim—1st, The described machine for printing or multiplying photographic pictures. 2d. The described art of multiplying positive photographic pictures or expressions from the same negative upon the same sheet of sensitive paper, or other material. 3d, Causing the sensitive material used for the reception of photographic impressions, latent or otherwise, made by the agency of solar or other light, passing through a negative, to traverse the aperture or negative employed. 4th, The traversing bed, whether cylindrical or plane, confined within a dark chamber, whose surface may be moved by ratchets, screws, cranks, or their equivalents, for the purpose of carrying the sensitive material when the same is used in connexion with a negative, from which it receives positive impressions. 5th, The employment of continuous sliding or revolving discs, with springs and spring-stops, or their equivalents, to give them a uniform motion and overcome the momentum or rebound, for admitting and shutting off light uniformly to and from all parts of the surface to be acted upon in printing positive photographic pictures from a negative. 6th, The application of a lens or lenses for the purpose of condensing light, when used in combination with negative 28, the sensitive material, and slide or cut-off, for admitting or shutting off light, for the purpose of photographic printing. 7th, The combination of condensing lens, 33, negative, 34, daguerreotype tube, 75, with its lenses, 76, the sensitive material and slide or cut-off for photographic printing. 8th, The combination of the sensitive material, negative, 28 (as destinguished from negative, 34), and slide or cut-off, for the purpose of photographic printing. 9th, The method of raising the glass negative or other matrix, 28, from the sensitive material, to permit the motion of the latter, and the method of lowering again. 10th, The method of supporting and adjusting negative, 28, as described. 11th, The use of the glass negative (when negative 28 is used), or the use of a piece of plain glass in the place of it (when negative 34 is used), or the use of a skeleton frame, for the purpose of pressing the sensitive material smoothly and evenly on roller 5, or traversing bed, while the photographic impression is being made. 12th, The alternate admission and exclusion of light passing through a negative, to act upon a traversing sensitive material, confined in a portable dark chamber. 13th, The rod, 8, working through hollow slotted shaft, 6, and affixed to roller, 5, by plate, 9, for the purpose described. 14th, The combination of the lever, 12, with its spring-catch, 13, with the ratchet wheel, 14, nose, 82, of shield, 15, and slotted stop, 11.

231. Cut-off Gear for Steam Engines; Henry Whittington, Philadelphia, Pennsylvania.

Claim—The inclined spiral edges on the revolving and sliding sleeve, when the latter is applied to operate the cut-off valve, the descent of which is caused by the pressure of steam above the valve, and when the inclined edges serve to retard the descent of the valve.

232. Washing Machine; Asbury Wilkinson, Madison, Indiana.

Claim—The combination of circular boards suspended from a frame above by springs, with a rotary corrugated roller working between them, constructed as set forth.

233. Registering Apparatus; Jephtha Avery Wilkinson, Brooklyn, New York.

Claim—A series of counting discs standing at right angles, or nearly so, to each other, and each formed with a thread or worm around its periphery taking teeth on the next counting disc, in the manner specified. Also, the arrangement of the counting disc, p9 and p10, in the manner specified, whereby they can be disconnected and set to commence counting when required.

234. Try-cock for Steam Boilers; John F. Cook, Assignor to self and George F. Page, Baltimore, Md.

Claim—Combining with the barrel of a try-cock a two-armed lever, one provided with springs or weights, and the other with a rubber (or other equivalent disc), so that the weighted arm shall hold the valved or disc arm against the bore of the barrel of the cock, as described.

235. Railroad Chairs; Henry W. Gray, Cleveland, Ohio, Assignor to self and W. H. Alvord, Homer, N. Y.

Claim—The forming the railroad chair in two sections, having the outer surfaces convex, in combination with the gripe and beam, arranged in the manner set forth.

236. Presses; Horatio Francis Hicks, Assignor to Hicks Brothers, Grand View, Indiana.

Claim—The combination of stepped bearings, with rollers adapted to operate in connexion therewith, without endwise pressure or tendency to displacement, in the manner set forth.

237. Deep Sea Sounding Apparatus; George W. McCord, Assignor to self and J. F. Lobdell, Centralia, Ill., and V. N. Davis, Rush, New York.

Claim—The arrangement of the cylinder, piston, graduated scale, cap, and vernier or register, constructed as described, for the registration of marine soundings upon the principle of hydraulic pressure.

238. Machine for Shaping and Finishing the Backs of Books; G. H. Sanborn, Boston, Mass., and John E. Coffin, Portland, Maine, Assignors to G. H. Sanborn, aforesaid.

Claim—1st, The employment, for shaping or finishing the backs of books, of a divided roll or pair of segments, operating across the backs from the centre to both sides thereof. 2d, The combination of the cam, T, slide, toggle, F F, spring, link, y, lever, link, u, and toggles, F F, with the book-holder, for the purpose of raising the holder and causing it to close upon the book before each operation of the divided roll or pair of segments. 3d, Attaching the segment levers, G G′, or their equivalents, to levers, H H, operated by cams, N N, on the constantly revolving main shaft, for the purpose of throwing the segments out of the way of the holder, at the proper stage of the operation of the machine, to permit the removal and introduction of the books.

239. Stoves; Thomas Shaw, Assignor to self and J. C. Bailey, Philadelphia, Pennsylvania.

Claim—1st, The adjustable legs, when combined with the casing and its gauge cylinder, and arranged so as to serve the double purpose of tilting the stove more or less on one side, and regulating the admission of air into the casing. 2d, Operating the valve for regulating the flow of gas into the casing, by means of the object to be heated by the flame, in conjunction with the devices set forth, or their equivalents.

240. Converting Reciprocating into Rotary Motion; A. T. Underhill, City of New York, Assignor to C. R. Underhill, New Castle, New York.

Claim—The arrangement and combination of the frame, guards, and ratchet wheels, so that the rotation of the shaft may be reversed, as set forth.

241. Machinery for Perforating Hat Bodies; Wm. F. Warburton and Wm. B. Atkin, Assignors to Wm. F. Warburton, aforesaid, Philadelphia, Pennsylvania.

Claim—1st, The system of pointed pins, hung independently of each other to the cross-head, furnished each with a separate spring, and arranged in combination with the hat block attached to the face plate on the spindle. 2d, The ratchet wheel of the same form, or thereabouts, as that presented by a transverse section of the hat to be perforated, in combination with the face plate and its hat block, the said wheel being operated by the pawl and the appliances connected therewith, or their equivalents, in the manner set forth.

242. Mode of Distilling Liquids from Coal Tar; Morris L. Keen, Rogers' Ford, Pennsylvania.

Claim—The application of additional heat at or near the surface of the coal tar, or other similar hydrocarbon, when used in combination with pressure in the boiler, for the purpose of preventing the tarry foam from rising and over-running the still, and thus endangering the operator as well as the premises.

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243. Churn; Abel Austin, Altona, Illinois.

Claim—The arrangement of the shaft, cranks, dashers, handles, links, springs, c c c, box, spring, g, and lid, constructed as described.

244. Rotary Blower; Wm. B. Barnard and Edmund Jordan, Waterbury, Connecticut.

Claim—The diaphragm, in combination with the revolving propeller or propellers to deflect the blast to the mouth or opening, as the blower revolves in the case.

245. Camp Stool; Elbridge G. Belknap, Philadelphia, Pennsylvania.

Claim—The combination of the case and the seat frame with the swivel blocks, braces, and connecting rod, arranged in the manner described.

246. Seed Planters; Lewis Reese Carpenter, Lancaster, Ohio.

Claim—The arrangement of the beam, handles, braces, furrowing scraper, and seed box, with the planting slide, lever, wheel, and covering scrapers, constructed as described.

247. Machines for Preparing Tobacco for Pressing; Edwin S. Collin and Thomas N. Read, Aspen Wall, Virginia.

Claim—The arrangement of two, three, or more pairs of progressive pressure rollers with each other, in the manner set forth. Also, combining a series of oil vessels and oiling pads with the aforesaid pairs of pressure rollers, in the manner set forth.

248. Machines for Splitting Welts; John Critcherson, and Eri S. Moulton, Boston, Massachusetts.

Claim—The beveled grooves, arranged in reference to each other, on the cylinders, and operating in combination with the adjustable cutter, as set forth.

249. Harvesters; Tobias Crumling, Hellam, Pennsylvania.

Claim—The arrangement and combination of the independent platform with the frame, belt, and driving axle.

250. Reels for Harvesters; George S. Curtis, Chicago, Illinois.

Claim—The employment of sliding heads, and pivoted arms, and bars, in combination with the reel shaft and beaters, described so that the diameter of the reel can be expanded or contracted.

251. Harvesters; Jacob D. Custer, Norristown, Pennsylvania.

Claim—1st, The main shoe, constructed in the manner described, in combination with bars of main frame and supporting bar, in the manner described 2d, The caster wheel, in combination with the lever and adjustable plate, arranged in the manner described.

252. Telegraphic Cable; J. S. Davison, Cranberry, New Jersey.

Claim—Arranging a series of loose metal strips in a coil, or its equivalent, as described.

253. Bedstead; Eben Eaton, Cincinnati, Ohio.

Claim—The construction of bed-posts with the wedge-formed part and the square piece attached, so as to form a shoulder to receive the rail, in combination with the bottom or platform of a bedstead, with the rail formed so as to fit the posts described, and all permanently connected together by means of cross-pieces.

254. Mode of Coloring Woolen Hats; G. D. Foote, Danbury, Connecticut.

Claim—The described process of restoring the color of the hats after they have been dipped in the stiffening and rubbed off by sand paper, by applying the hot dyeing liquid.

255. Rolling Mills; John and George Fritz, Johnstown, Pennsylvania.

Claim—The application to each of the pairs of drawing or forming rolls of a feed roll, such as described, and driven by gearing or other machinery, and turning in the same direction with said drawing or forming rolls, for the purpose of carrying and feeding into them the pile or bar of heavy iron.

256. Apparatus for Washing Gas; Harvey Guild, New Orleans, Louisiana.

Claim—The arrangement of the water-pipe and rose within the inlet pipe of the wash-box, in combination with the perforated plate or diaphragm, at the junction of the inlet pipe, with the wash-box.

257. Belt-hook, Pliers, and Punch; N. E. Hale, Nashua, New Hampshire.

Claim—1st, The combination of the roughened surfaces with the triangular wedge end, arranged in relation to each other, as set forth. 2d, The combination of the jaws with the punch, roughened surfaces, and wedge end, constructed as set forth.

258. Method of Distilling Oil from Coal; John Howarth, Salem, Massachusetts.

Claim—Forming oleaginous vapor from coal, or other substances, yielding pyrogenous oils, by passing through the material to be acted upon, a current of superheated steam, in combination with steam direct from the boiler, in the manner set forth. Also, forming oleaginous vapors from coal, or other substances, yielding pyrogenous oils, by passing through the material to be acted upon, air combined with superheated steam, in the manner set forth.

259. Bedstead Slats; Tyler Howe, Cambridgeport, Massachusetts.

Claim—The described bed slat, consisting of the lifter, in combination with the slat, constructed in the manner set forth. Also, the construction in the ends of slats, by which they are connected with the bedstead or springs, as described.

260. Mode of Arranging Couches in Railroad Cars; Edward C. Knight, Philadelphia, Pennsylvania.

Claim—The arrangement of couches in railroad cars by means of the double-hinged rod, constructed in such a manner that the couch, when not in use, may be folded up against the ceiling and retained there by means of a button, or other suitable device.

261. Screw-wrench; W. Kuhlenschmidt, City of New York.

Claim—The arrangement and combination of the conical disc with the helical groove, the spring, the movable jaw, and the shank, to operate as set forth.

262. Moulding Water-traps; James Allen Lowe, City of New York.

Claim—The application of a metallic core, constructed and operating as described, to cast water-traps.

263. Cooking Stoves; James L. Meafoy, Middleton, New York.

Claim—The cylindrical fire chamber and air chamber, communicating with the fire chamber and the heater chamber, arranged relatively with each other and the oven, for the purpose set forth. Also, in combination with the fire chamber, air chamber, and heater chamber, arranged as shown, the perforated plate placed in the flue relatively with the fire chamber.

264. Machines for Distributing Fertilizers; Z. N. Morrel, Cameron, Texas.

Claim—The combined arrangement of the single side-wheel, distributing wheel, regulating slide, revolving arms, boot, set-screw, shares, cog-wheels, draft rod, sprocket wheels, roller, and chain, in the manner set forth.

265. Process of Distilling Oils from Coke; George Mowbray, Green Point, New York.

Claim—In the manufacture of coal oils and other pyrogenous oils, by exposing the coal, or other materials, to the products of combustion generated in a separate furnace, I claim igniting said products of combustion, previous to admitting the same into the distilling kiln, by admixture of a sufficient proportion of air, to burn the oxide of carbon into carbonic acid.

266. Writing-tablet; George Munger, New Haven, Connecticut.

Claim—An argillaceous surface wood writing-slate, which is formed by uniting several layers of veneering or thin wood together, so that their grains run antagonistic to one another, and then coating the exterior surfaces of the compact mass with a composition of slate, emery, or other similar argillaceous material.

267. Bed-spring; S. D. Newbro', Lansing, Michigan.

Claim—The employment of the oblong plates, whether made of wood or of metal, or any other suitable material, when the same are secured together, as set forth.

268. Manufacture of Wire Cloth; Rufus Nutting, Randolph, Vermont.

Claim—Compressing wire cloth by passing it between rollers suitably constructed, or by equivalent means, whereby its surfaces are rendered smooth and even, in the manner specified.

269. Stoves; Oscar Paddock, Watertown, New York.

Claim—The damper arranged over the pipe through which a direct communication between the fire-place

and the chimney is effected and operated by means of a rod, or its equivalent, which is secured to the door, and which acts against a forked lever, as specified.

270. MANUFACTURE OF HOES; Andrew Patterson, Birmingham, Pennsylvania.

Claim—Forming the head or eye of a hoe and attaching it to the blade at the same time, by pouring the molten metal to form the head on or around the blade.

271. CONSTRUCTION OF PACKING-BOXES; Edward L. Perkins, Roxbury, Massachusetts.

Claim—1st, Forming the sides, ends, bottom, and top of the box with, or attaching thereto, the right angular shaped braces or shoulders formed with beveled corners, so as to make a close and binding joint. 2d, In combination with the above, I claim the cover formed in two wedge-shaped pieces, or in any manner substantially similar, whereby all the parts constituting the box are drawn and held rigidly together.

272. MUFFS; Jane Phillips, City of New York.

Claim—A muff, arranged with a cut in its side covering or shell, an annular space or pocket, and a portemonnaie secured in its inner part.

273. HOOPS OF SKELETON SKIRTS; Joseph F. Pond, Cleveland, Ohio.

Claim—The combination of the eye on one extremity of the hoop, with the series of set-offs on the other, constructed as set forth.

274. SECURING IRON BANDS ON COTTON BALES; C. W. Pyle, Galveston, Texas.

Claim—A plate, constructed with a short open slot, a long closed slot, and a turned down lip or flanch.

275. SPRING HINGE; Cornelius J. Rooney and David Renshaw, City of New York.

Claim—The arrangement of the coiled spring, shaft, and wings, in combination with each other, for the purposes stated.

276. BURGLARS' ALARM; Abbott Q. Ross, Cincinnati, Ohio.

Claim—Connecting the doors or windows of a house to an alarm mechanism, through a system of strained wires, so that the forcing of a door, or the cutting of any wire shall let off the alarm mechanism. Also, connecting the panels of a door with the strained wires that unite the door with the alarm mechanism, as that the cutting out of a panel, or the cutting of one of the wires, shall let off the alarm mechanism. Also, the combination of the swinging lever on the door, with the bolt and its inclined plane that locks the spring drum, for the purpose of putting said door in connexion with the alarm mechanism, when said door is drawn to, and shut from the outside.

277. HORSE HARNESSES; John Rouse, Port Gibson, New York.

Claim—The double-eyed hook, arranged as described in the yoke ring, so as not to be withdrawn therefrom, in combination with said ring and with the divided hame straps, which are respectively secured to the opposite eyes of the hook.

278. STEAM PUNCHING MACHINE; John Sparrow, Portland, Maine.

Claim—The employment of a single-acting cylinder and piston, operated by the pressure of steam, water, or other fluid, and a toggle, arranged relatively to each other and the punch or cutter, as described.

279. METHOD OF OPERATING INDEPENDENT SECOND HANDS OF STOP-WATCHES; Peter M. Satzell, Philadelphia, Pennsylvania.

Claim—1st, The independent second hand adapted to a watch, so that by means of the devices described, or their equivalents, the said hand may be connected to, or disconnected from, the time train of the watch, without interfering with the movements of the latter. 2d, The stop-arm, with its forked end so adapted to the hollow arbor as to serve the purpose of stopping and releasing the said arbor, and at the same time serving to maintain it in its proper vertical position. 3d, The wheel with the springs, in combination with the hollow arbor of the independent seconds hand, the wheel being hung loosely to, and the spring bearing against, the said arbor.

280. SAFETY ENVELOPE; William J. Stetson, Baltimore, Maryland.

Claim—The mode of giving security to letter, and other envelopes, the same consisting in water-proofing that part of the envelope upon which the adhesive material is applied.

281. CONSTRUCTION OF GAS BURNERS; John Stevens and John Johnson, City of New York.

Claim—The apertures, in combination with the movable slide, or its equivalent, whereby the area of the passage for the gas or vapor is contracted at pleasure at the point of its exit in the atmosphere, and the volume of the flame diminished, without substantially changing its character. Also, the arrangement of the branches, diverging from a single pipe, and pressing by their elasticity against the opposite side of the slide, for the purposes explained.

282. CHAMBER UTENSIL; J. C. Stoddard, Worcester, Massachusetts.

Claim—A chamber vessel provided with a flanch and elastic ring, made as described, so as to form a tight joint, and also to prevent noise.

283. MACHINES FOR SCOURING AND HULLING BUCKWHEAT; Joseph N. Treadwell, Redding, Connecticut.

Claim—The arrangement of the revolving and graduated screws with the hoppers, conveyors, blasts, and conductors, in the manner described.

284. SMUT MACHINES; Richard Ward, Edinburgh, Indiana.

Claim—The employment of the corrugated iron plate, having the horse-shoe perforations, in combination with the iron plate having the diamond perforations, in the construction of a perforated scouring and separating cylinder, arranged to operate as set forth.

285. SEED PLANTERS; S. J. Wasterburg, Altona, Illinois.

Claim—The arrangement of the block provided with chambers, C, and chambers B, with the rods, shaft handle, hopper, spring, I, slides, and spring, G, as set forth.

286. STOVES; C. L. Whitney and Samuel Reed, Genesco, Illinois.

Claim—1st, The arrangement of deflecting plate, chamber, graduating damper, and flue-pipes, in the four corners of the oven, all in combination for the purposes set forth. 2d, In combination with this, we claim the use of pipes of clay, or other similar material, arranged in the manner set forth.

287. ABDOMINAL SUPPORTER; A. B. Weaver, Carthage, Indiana.

Claim—The employment of the hip bands and centre hip straps, in combination with the straps, arranged as set forth.

288. Method of Raising Water by Animal Power; Zatter F. Wilder, Painted Post, New York.

Claim—The arrangement of a series of platforms, in combination with a pump, so that a series or a succession of strokes of the pump piston shall be produced before the cattle arrive at the drinking trough.

289. Hand Punch; Reuben Wood, Grand Ledge, Michigan.

Claim—1st. The peculiar relative arrangement of the two series of inclined planes, in the contact faces of the circular plates, to be used either with or without interposed balls or rollers, in the manner specified. 2d. The use of the slotted tube, in combination with the two inclined ways and cross-bar (with or without the rollers), for the purpose of extricating and lifting a punch, or other tool, in the bar, by a reversed motion of the lever.

290. Cotton Gins; John Wilson, Anderson C. H., South Carolina.

Claim—1st. The employment of three or more toothed or serrated cylinders, arranged and disposed so as to operate as set forth. 2d. In connexion with the cylinders thus arranged and disposed, the rotating stripping brushes and adjustable plug or register, to ensure respectively the proper discharge of the lint and the seed.

291. Manufacture of Sheet Metal; Henry W. Wimshurst, Dalton, England.

Claim—The improvement in the manufacture or production of sheet metal or metal foil, by cutting the same from a block or solid mass, by means of a cutting mechanism, in lieu of rolling or beating the same by means of rolling or beating mechanism, as has heretofore been done.

292. Door Spring; O. D. Barrett, Assignor to self and J. F. Keeler, Cleveland, Ohio.

Claim—The levers, in combination with the connecting rod and the springs, constructed as specified.

293. Stave Machine; James Decker, Assignor to self and A. P. McRae, Reidsville, Georgia.

Claim—The combination and arrangement of the convex and concave cutters, bed-piece, tonguing and grooving cutters in the heads, and the cam, attached to the pressure hub or roller, and lever connected with the said cam, and the shaft of cutter head, as set forth.

294. Manufacture of Cigar-wrappers; Francis Dixon, Lynn, Assignor to self and Moses Sweetzer, Newburyport, Massachusetts.

Claim—A new article of manufacture, the same consisting of tobacco leaf reduced to pulp, and converted subsequently into sheets, or other desirable form suitable for use, or in the making of cigar-wrappers.

295. Machine for Shaping Heels for Boots and Shoes; Luther Hall, Assignor to self and S. S. Hemenway, Boston, Massachusetts.

Claim—The combination of the stationary bed-plate, the movable cutter-carriage, provided with self-adjusting cutters and carriers, adjustable clamps, a guide friction wheel, and a curved rack and pinion, arranged as set forth. Also, combining with the adjustable clamps an adjustable holder and former, so constructed and arranged as not only to co-operate with the clamp in maintaining the heel of the boot or shoe firmly in position but to serve as a pattern, to give the heel any desirable contour on its bearing surface. Also, the peculiar construction of the secondary cutter carriage set forth, and the arrangement of the secondary cutter with respect to the primary cutter, the guide friction wheel, and the heel-tread former, whereby the secondary cutter is rendered capable of giving to the lower or bearing surface of the heel any form that may be desired.

296. Bungs of Casks; John Keane, Assignor to self and Andrew McLean Wood, City of New York.

Claim—Providing a bung or spigot, with reservoir for spirit, and a system of pipes or passages, or their equivalents, so arranged as to cause all the air entering the cask to pass through the spirit in said reservoir. And in combination with such a reservoir and system of pipes or passages, or their equivalents, I claim a valve, applied to the bung or spigot.

297. Portable Gas-holder; James McFarlan, Assignor to James McFarlan, Jr., and E. McFarlan, Brooklyn, New York.

Claim—The construction of the gasometer, with its upper portion of conical form, with flexible sides and with a stiff head, and of such size that it may be introverted within the stationary tank-like portion to which its flexible sides are attached.

298. Grain Separators; Jefferson Nash, Janesville, Assignor to Alonzo K. Cutts, Fulton, Wisconsin.

Claim—The arrangement and combination of the vibrating lever, the elbow crank, and the rods, whereby the motion of the shoe can be changed from a longitudinal to a transverse direction, and vice-versa.

299. Making Gas from Wood; August Schmidt, Assignor to self, Charles, Edward, and Herman Schmidt, City of New York.

Claim—The arrangement of the arch-shaped retort and narrow flues with the arch of the retort, in the manner specified.

300. Making Gas from Rosin; August Schmidt, Assignor to self, Charles, Edward, and Herman Schmidt, City of New York.

Claim—The retorts and its flues, combined with the receptacle or kettle, and arranged in the manner specified.

301. Apparatus for the Production Hare's Hydro-oxygen Light; George Hand Smith, Assignor to S. O. Smith, Rochester, New York.

Claim—1st. The use of carbureted hydrogen of gas, in combination with the atmospheric air or oxygen gas, in proportions desired, operating under condensation through a proper regulator, and discharging through jets of minute orifice upon, and rendering incandescent any proper radiating material of any form, being independent of any atmospheric circumstances or situation, in the manner and through the means and machinery. 2d. The arrangement of four jets or burners for directing the impact of gases on incandescent surfaces, such burners having minute orifices pointing to a common centre, three of them placed so that their orifices of discharge shall be within, or nearly within, one quarter of the circumference of a circle drawn through them from the centre to which they point (being not more than one-eighth of such circumference distant from each other), and the orifice of the fourth being diametrically opposite in such circle to the middle orifice of the other.

### Extensions.

1. Cooking Stoves; C. J. Woolson, Cleveland, Ohio; patented September 9, 1845; extended Sept. 13, 1859.

Claim—The forming of the bottom plate of the oven with a number of tubes or boxes, usually of sheet iron, or other substance, thinner than the bottom plate that descends from it, through the lower flue-space, the same being effected under an arrangement of their respective parts, substantially the same with that described.

2. Mode of Tripping Cut-off Valves; Frederick E. Sickles, City of New York; patented Sept. 19, 1845; extended September 13, 1859.

Claim—Tripping the drop valve of the cut-off by a motion independent of the lifter, in the manner described. Also, combining the wiper that drops the valve of the cut-off, whether working horizontally or vertically, with any of the moving parts of the engine, other than the lifters or their rocking shaft, by means of the sector and arm or arms, by means of which the extent of the cut-off can be regulated at pleasure during the action of the engine, from the full to the least portion of the stroke.

### Re-Issues.

1. Revolving Fire Arms; Wm. S. Lavely and James M. Cooper, Assignees of Josiah Ells, Pittsburgh, Penna. patented August 1, 1854; re-issued September 6, 1859.

Claim—1st, The use of a stud in the trigger vibrating laterally, in combination with a bevel-edged hammer, for the purpose of raising the hammer to full cock, and firing the piece by simply pulling the trigger, which, after the discharge of the piece, will regain its position for repeated action, or (as a mere modification of arrangement) the use of a stud in the hammer vibrating laterally, in combination with a bevel-edged trigger, for the purpose specified. 2d, The use of a bevel-edged hammer, with or without a notch in its toe, and trigger with vibrating stud or cam for the trigger spring, for the purpose of causing the hammer, trigger, and revolving breech to assume their proper relative positions at full cock by simply pulling the trigger, and retaining them in that position, and securing the breech from rotation or displacement preparatory to firing. 3d, The notch or depression in the toe of the hammer at the point of contact of the stud and edge of the hammer, in combination with the laterally vibrating stud, for the purpose of preventing the slipping of the stud and the more easy retention of the hammer at the point of full cock. 4th, The mode described of locking the rotating breech at the moment of firing, by means of the locking bolt operated by the trigger, in combination with the hexagonal neck of the rotating breech, which nevertheless permits the breech to be freely rotated by hand or otherwise, when the trigger is not drawn back. 5th, The use of a double trigger spring or spring and lever, for the purpose set forth.

2. Ornamental Connexion of the Parts of an Iron Fence; Henry Jenkins, Cincinnati, Ohio; patented Jan. 30, 1852; re-issued September 6, 1859.

Claim—Forming the ornament or cast iron connexions for a railing, fence, or other article of iron, cast into a divided iron mould, substantially as specified.

3. Straw Cutters; Jacob H. Mumma, Harrisburgh, Pennsylvania; patented January 26, 1858; re-issued September 6, 1859.

Claim—1st, The combined application to straw-cutting machines of a changeable feed gear, with two-edged revolving cutters or blades, when so made that, by changing them end for end on their arms or supports, they shall bring a different cutting edge into action, or when run in either direction, shall always feed in the material in one and the same direction. 2d, The combination of feed rollers acted upon by tappets, and the crushing rollers controlled by gum elastic springs, when arranged in relation to, and acting in connexion with, the cutting apparatus.

4. Sewing Machines; John W. Marsh, Oxford, Massachusetts; patented October 27, 1857; re-issued September, 6, 1859.

Claim—1st, The combination of the slide, provided with its guard or its slot or slots with the foot-piece, with its guide and slots, arranged and operating as described. 2d, The combination with the sewing apparatus, or its equivalent, of a movable knife operated by a connexion with the sewing machine, so as to trim or cut the work whilst being sewed, in the manner described.

5. Lamps; William Fulton, Cranberry, New Jersey; patented August 3, 1858; re-issued Sept. 13, 1859.

Claim—1st, The perforated plate or air distributor, or its equivalent, for the purpose of regulating the elastic force of the air so that it may be presented evenly to the flame (when applied to flat wick lamps), it being placed horizontal. 2d, The perforations in the lower part of the cap, in combination with the perforated or air distributing plate. 3d, The register, formed of the perforations in the top, in combination with the perforated plate or air distributor, and the holes in the lower part of the cap, arranged as described.

6. Heating Elevated Ovens; P. A. Palmer, Troy, New York; patented September 24, 1850; re-issued September 13, 1859.

Claim—The arrangement and combination of reversible flues in elevated ovens of cook stoves, with partition walls, in the manner described. Also, the arrangement and combination of the oven plate, in and with the inner plate and ends of the oven. Also, the arrangement of the damper immediately between the main part of the stove and the bottom or lower part of the elevated oven, thereby combining it with the said oven, the stove, and the double flue, for the purpose of controlling and regulating the heat in its passage into the flues of the said elevated oven, as described, disclaiming any damper found in any stove not having an elevated oven, as set forth.

7. India Rubber Fabrics; Henry B. Goodyear, Administrator of Nelson Goodyear, deceased. City of New York; patented May 13, 1845; extended for 7 years from May 13, 1853; re-issued September 13, 1859.

Claim—Making fabrics by thoroughly intermingling and incorporating the shearings or clippings of fibrous substances with the gum while rendered plastic by heat, as specified.

8. Machine for Bending Metal Pipe; James Perkins and Wm. H. Burnet, Newark, New Jersey; patented October 14, 1856; re-issued September 20, 1859.

Claim—The mandrel, as described, and therewith traversing roller, or its equivalent, for bending coils of metal pipe, and, in combination therewith, the furnace, in the manner set forth.

9. Cultivator Teeth; David B. Rogers, Pittsburgh, Pennsylvania; patented November 1, 1845; re-issued September 20, 1859.

Claim—Making the shank or upper part of cultivator teeth of thin plate-steel, U-shaped or curved round in front, for the purpose of securing the necessary strength to permit the tooth to be made entire, shank and blade of a single piece of metal, and also of enabling the tooth to be secured in its place in the beam by means of a wedge driven into the cavity of the shank.

10. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The arrangement of a cutting apparatus and a reel, with respect to a driving wheel and a grain wheel, or its equivalent, and a raker's seat, or its equivalent, so that the major part of the weight of the cutting apparatus and reel shall be in advance of the axis of oscillation of the machine on the said wheels, while the raker's seat or stand shall be located behind that axis, and the machine, with the raker thereon, nearly balanced on its axis of oscillation.

11. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination of a tongue, or its equivalent, to draw the machine by, a driving-wheel and gearing arranged at the side of the machine, a short platform, a reel to gather the grain to the platform, and a stand or seat for the raker, fixed upon the machine, so as to enable the raker conveniently to discharge the grain and lay it in gavels upon the ground at the side of the swath, and out of the return path of the horses.

12. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—A seat or stand on the reaping machine for the support of the raker, laterally and in front.

13. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination of the reel, the divider, and the raker's seat or stand, co-operating together in such manner that the grain deposited upon the platform and divider may readily be grasped and discharged from the machine by the raker at his seat.

14. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination, in a reaping machine, of the draft and the gearing, arranged at the side of the machine—two compressors, one arranged at each end of the cutter, the short reel to sweep over the space between the compressors and the short platform.

15. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination of the grain-guarded platform, to receive and retain the cut grain, with the divider and the reel.

16. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The combination of the reel support at the rear part of the outer side of the platform, with the low flat frame and the divider.

17. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—The arrangement of the frame, the finger-beam, and the platform, and the driving-wheel and gearing, relatively to each other, so as to secure an unobstructed gavelling space at the side of the platform, behind the finger-beam.

18. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1853; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—A reaping machine frame, consisting, namely, of two principal beams, crossing each other, and arranged relatively to the supporting wheels, so as to give support to a platform not extending behind the gearing, and without interfering with the cutter on one side or the gavelling space on the other.

19. REAPING MACHINES; Cyrus H. McCormick, Chicago, Illinois; patented October 23, 1847; re-issued May 24, 1855; re-re-issued December 21, 1858; re-re-re-issued September 20, 1859.

Claim—1st, A dividing board, having a surface inclined towards the cutter and platform, and an outer dividing line and an inner dividing line, and acting as described. 2d, The combination of the inclined dividing board with a guide bar. 3d, The combination of a reel with the inclined dividing board. 4th, The combination of a reel with the dividing board and guide bar.

20. MAGNETIC PRINTING TELEGRAPHS; Royal E. House, Binghampton, New York; patented April 18, 1848; re-issued September 20, 1859.

Claim—1st, A series of keys, each corresponding to a character, in combination with a revolving part of a circuit, so that the touching of one of the former may cause the circuit to be broken or closed for the purpose of printing, when the revolving part of the circuit is in a certain required angular position, properly corresponding to the key struck. 2d, A series of keys, each corresponding to a character, in combination with a revolving portion of a circuit and a shaft provided with pins, arranged in a helix, or the equivalents of the whole, acting to cause the circuit to be broken or closed when the revolving part is in a certain angular position, in proper correspondence with the key struck, for the purpose of printing a proper corresponding letter by means of any suitable machinery. 3d, A key-board or series of keys, in combination with a rotating portion of a circuit and a type-wheel, or its equivalent, so governed as to present a proper letter corresponding with a key touched to produce an impression. 4th, In combination with a single circuit of conductors, a key-board or series of keys, a revolving portion of a circuit, and a type-wheel, and these also in combination with a printing press, and with a key-shaft, or either of them. 5th, A series of keys, each corresponding to a character, in combination with a type-wheel having similar corresponding characters, when so connected by any appropriate devices that a certain type shall be in a certain locality when a corresponding key is actuated—and I claim these two elements, in combination with a single circuit of conductors and with a printing apparatus, or either of them. 6th, Actuating or driving a revolving portion of a circuit or a key-shaft, or both of them, by means of a prime-mover acting upon them through a friction connexion, the mode of operation being substantially as specified, and doing away with sudden jars and increasing rapidity of operation, when contrasted with a positive connexion between such parts and a prime-mover, and also permitting the two to move with varying velocities. 7th, Actuating or driving a key-shaft and a revolving portion of a circuit, or either of them, by means of a friction connexion with a prime-mover, when the velocity of such prime-mover is controlled by a governor, or some equivalent for the purpose, which either prevents its moving too fast or increases its velocity when going too slow, or performs both these duties. 8th, Governing or controlling the motions of a prime-mover, which actuates a printing apparatus by the breaking and closing of an electric or galvanic circuit, so that such apparatus is put in operation by the breaking of a circuit and by the closing thereof—and also the controlling of a printing apparatus, so that it shall be permitted to print

when a spring returns to its normal position at the time that a circuit is broken, the mode of operation being substantially such as set forth. 9th, In a printing telegraph, moving the paper to the types to produce an impression on the former, in the manner described, as distinguished from former modes of operation, by which the types were moved towards the paper. 10th, In combination, a revolving type-wheel and a roller, or its equivalent, charged with coloring matter, so as to deposit such matter on the types as they, in succession, come in contact with the roller—and this I claim also when the roller is grooved. 11th, Being aware of the facts that type-wheels have been permitted to revolve, step by step, when controlled by escapements, and when such escapements have been actuated either by a prime-mover governed by a pendulum, or by electric-magnetic force, I claim actuating an escapement which controls the motions of a type-wheel by a prime-mover, whose motions are regulated by the breaking and closing of a circuit, under a mode of operation such as described, whereby a small force, derivable from magnetism, controls any necessary power of a prime-mover, there being a breaking and closing of a circuit correspondent with each vibration of the escapement. 12th, A hydraulic regulator, such as described. 13th, A hydraulic regulator, in combination with a type-wheel, and a printing apparatus, and a prime-mover, and causes the press to print when the type-wheel ceases to move for a longer time than usual. 14th, In combination with a type-wheel and a printing press or apparatus, I claim apparatus such as specified, for making an alarm when that apparatus is permitted or caused to act by the breaking and closing of the same circuit of conductors, which, by its breaking and closing, permits the printing apparatus to come into action.

21. MACHINES FOR THREADING SCREW BLANKS; Elliot Savage, Berlin, Assignor to self and Charles Parker, Meriden, Connecticut; patented Nov. 21, 1854; re-issued September 27, 1859.

Claim—The method described of causing the chasing tool to act upon the screw blank in producing both the cylindrical part and the tapering point, that is to say, by so governing the relative positions of each to the other, that while threading the cylindrical portion the chasing tool shall be presented at a right angle to the axis of rotation of the blank, and while cutting the tapering part shall be so inclined acutely to said axis that the line of travel of the face of the chaser shall finally intersect said axis.

22. MACHINES FOR THREADING SCREW BLANKS; Elliot Savage, Berlin, Assignor to self and Charles Parker, Meriden, Connecticut; patented Nov. 21, 1854; re-issued September 27, 1859.

Claim—A wood screw of which the entering end is made to taper, in the manner set forth, that is to say, by giving to the core thereof a form bounded in any plane which passes through the axis of rotation, by lines which converge toward, and if produced, will intersect said axis, in contradistinction to the known form wherein the bounding lines in such planes are parallel to said axis.

23. WASTE DEVICE FOR HYDRANTS; Joshua Register, Wm. George Webb, J. S. Roche, and John McCart, Assignees of John Calver, Baltimore, Maryland; patented April 22, 1856; re-issued Sept. 27, 1859.

Claim—The described arrangement of the plunger relative to the discharge pipe, and capable of elevation proportioned to the capacity of said pipe by forming a chamber in the lower portion of the hydrant for the reception of the contents of the discharge pipe. Also, in combination, the arrangement of the valve, by means for operating it by the spring.

24. SEWING MACHINES; Joseph W. Bartlett, City of New York, Assignee of O. L. Reynolds, Dover, N. H.; patented May 14, 1850; re-issued September 27, 1859.

Claim—1st, The employment and use in a sewing or tambouring machine of a needle or thread-carrier, having a movable or flexible beard or hook, and also the combination with the said needle or thread-carrier, of a mechanism for closing the beard thereof. 2d, The combination with a bearded instrument, used as before described, of the thread guide, having the motions described, such as shall carry the thread across the path of the bearded instrument, and present it to the action thereof, without carrying the thread around the shank of the said bearded instrument, in the manner described. 3d, The combination of the cam, lever, and guide, with a spring, whereby the thread is presented to the action of the bearded instrument.

25. CLOTHES DRYERS; Samuel Morrill, Andover, New Hampshire; patented November 14, 1856; re-issued September 27, 1859.

Claim—1st, Tilting the reel to the desired position to enable a person to place the clothes on the lines without high reaching, and elevate them in good position to dry, and out of the way of injury. 2d, Arranging and combining with a rotary tilting reel, the ratchet, and a pawl, or their equivalents, for preventing backward rotary motion of the reel as the clothes are placed on the lines, and moved along. 3d, Operating the reel by the combined action of the arm, jointed arm or lever, and loop or staple, or its equivalent.

26. MOWING MACHINES; Ephraim Ball, Assignor to Ball & Butler, and Ball & Butler, Assignors to Ephraim Ball, aforesaid, Canton, Ohio; patented December 1, 1857; re-issued September 27, 1859.

Claim—1st, The combination of the short curved arm with the bar and finger bar, arranged for joint operation as set forth. 2d, The combination of the coupling arm with bar, wrist, socket, hinge, and short finger beam, as set forth. 3d, Extending the coupling arm outside of the frame, in combination with the front hinges of bar also outside of the main frame, arranged in the manner described, whereby greater freedom of the movement of the cutting apparatus is secured.

27. MOWING MACHINES; Ephraim Ball, Assignor to Ball & Butler, and Ball & Butler, Assignors to Ephraim Ball, aforesaid, Canton, Ohio; patented December 1, 1857; re-issued September 27, 1859.

Claim—The combination of the independent driving wheel at the grain side of the machine, with the hinged bar to which the short finger beam is rigidly attached, and the hinged coupling arm, whereby the cutting apparatus may rise and fall freely, and the cutters be kept in operation while turning to the left upon uneven ground.

### DESIGNS.

1. HANDLES OF SPOONS AND FORKS; Philo B. Gilbert, City of New York; dated September 6, 1859.
2. CARPET PATTERN; Elmira J. Ney, Lowell, Massachusetts, Assignor to the Lowell Manufacturing Company; dated September 6, 1859.
3. HANDLES OF SPOONS, FORKS, &c.; Henry Hubbard, City of New York; dated September 13, 1859.
4. SKATING OR RIDING-CAP FOR LADIES; Eliza A. Murdock, Boston, Massachusetts; dated September 20, 1859.
5. COOKING STOVE; John Martino, Assignor to D. Stuart and J. R. Peterson, Philadelphia, Penna.; dated September 20, 1859.
6. CYLINDER STOVES; John Martino and James Horton, Assignors to D. Stuart and J. R. Peterson, Philadelphia, Pennsylvania; dated September 20, 1859.
7. SEWING MACHINE; S. B. Ellithorp, City of New York; dated September 27, 1859.
8. GAS COCKS, &c.; B. M. Johnson, City of New York; dated September 27, 1859.

## MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

*Details of the Steamer Great Eastern.* Collected and estimated by CHAS. H. HASWELL, New York.

Hull built by John Scott Russell & Co. Paddle-wheel engines designed by John Scott Russell and built at Millwall Works. Propeller engines built by James Watt & Co., Soho Works.

HULL.

| | | | |
|---|---|---|---|
| Length on deck over all, | 692 feet. | | |
| Length on deck, from fore part of stem to after part of stern post, above the spar deck, | 680 | " | |
| Breadth of beam at midship section, | 83 | " | |
| " over paddle-wheel guards, | 120 | " | |
| Depth of hold to spar deck, | 56 | " | 3 inches. |
| " " main deck, | 48 | " | 3 " |
| " " lower " | 41 | " | 3 " |
| " " berth " | 34 | " | 3 " |
| Height from rail to under side of bottom, | 62 | " | 4 " |
| Length of engine and boiler space, under lower deck, | 350 | " | |
| Tonnage, | 22,500. | | |

*WATER-WHEEL ENGINES.

Description—Oscillating.

" of Boilers—Horizontal tubular—furnaces at each end—one smoke-pipe in common for each set of two.

| | | | |
|---|---|---|---|
| Diameter of cylinders, four of | 74 inches. | | |
| Length of stroke, | 14 feet. | | |
| Diameter of water-wheels, | 56 | " | |
| Length of blades, | 13 | " | |
| Depth " | 3 | " | |
| Number " | thirty. | | |
| " of boilers, | four. | | |
| Length " | 17 | " | 6 " |
| Breadth " | 17 | " | 9 " |
| Height " | 13 | " | 6 " |
| Number of furnaces (five at each end), | ten. | | |
| Width " | 2 | " | 11 " |
| Length of grate bars, | 7 | " | |
| Number of tubes, | 3200. | | |
| Diameter " external, | 3 " | | |
| Thickness " | No. 12 wire gauge. | | |
| Length " | 5 | " | 4 " |
| Diameter of smoke-pipe, | 5 | " | 10 " |
| Height " | 86 | " | |
| Area of grate surface, | 370 | " | |
| Heating surface, tubes alone, | 17,600 | " | |
| Thickness of plates, Sides, $\frac{7}{8}$. Bottom, | 7-16. inches. | | |
| Front tubes, $\frac{1}{2}$. Back tubes, | 9-16. | " | |
| Maximum pressure of steam *in pounds*, | 25. | | |
| " revolutions *per minute*, | 16. | | |
| Point of cutting off, | one-fourth. | | |
| Weight of boilers, *without water*, each | 51 tons. | | |
| " water, | 39 " | | |

* The term "water-wheel" is according to the author's copy.

PROPELLER ENGINES.

Description.—Horizontal direct-acting.
" of boilers.—Same design as those for the water-wheel engines.

| | | | |
|---|---|---|---|
| Diameter of cylinders, | | | 84 inches |
| Length of stroke, | | 4 feet. | |
| Diameter of propeller, | | 24 " | |
| Pitch " | | 44 " | |
| Number of blades, | ten. | | |
| " boilers, | six. | | |
| Length " | | 17 " | 6 " |
| Breadth " | | 18 " | 4 " |
| Height " | | 13 " | 10 " |
| Number of furnaces (six at each end), | twelve. | | |
| Width " | | 2 " | 5 " |
| Length of grate bars, | | 7 " | 6 " |
| Number of tubes, | 4920 | | |
| Diameter " external, | | | 3 " |
| Thickness " | No. 10 wire gauge. | | |
| Length " | | 5 " | 6 " |
| Diameter of smoke-pipes, (three,) | | 6 " | |
| Height " | | 86 " | |
| Area of grate surface, | | 406 " | |
| Heating surface, tubes alone, | | 27,300 " | |
| Thickness of plates, Sides, | 7-16. Bottom, | ½ inch. | |
| Front tubes, | ½. Back tubes, | ⅝ " | |
| Maximum pressure of steam *in pounds*, | 25. | | |
| " revolutions *per minute*, | 55. | | |
| Point of cutting off, | one-fourth. | | |
| Weight of engines and boilers, | 1500 tons. | | |
| " boilers, *without water*, each, | 55 " | | |
| " water, each, | 45 " | | |
| Capacity of coal bunkers, in tons of coal, | 12,000 " | | |
| Consumption of coal per hour, estimated, | 10 " | | |
| Draft of water at load line, | | 30 feet. | |
| " " light " | | 20 " | |
| Area of immersed midship section at light draft of 20 feet, | | 1360 sq. ft. | |
| " " load " 30 " | | 2180 " | |

HULL.—Frame of wrought iron plates. Bottom doubled at an interval of 2 feet 10 inches, to a height of 39 feet from under side. Outer and inner plates ¾ of an inch thick—connected, fore and aft, by 36 fore and aft webs, ½ an inch thick—2½ feet apart at side of keel, and running to 4½ feet at top of sides, crosswise by webs every 10 feet. These webs are secured to the outer and inner plates by angle iron.

Description of coal, . . Bituminous and Anthracite.

*Details and Remarks.*—Four decks. Spar deck, 2 feet 5 ins. deep. Ten water-tight athwartship bulkheads. Two transverse bulkheads for 350 feet. Launching draft, 14 feet 6 ins.; displacement equal to 10,500 tons.

Each pair of cylinders of water-wheel engines is arranged to be detached from the other by a friction clutch, and each cylinder can be detached from connexion with the other.

All surfaces of cylinders, steam-chests, and steam-pipes are jacketed and heated by steam from an auxiliary boiler.

Estimated power, water-wheel engines at 11 revolutions per minute and 15 lbs. pressure. Cut-off at ⅓. 3000 horses; at 16 revolutions and 25 lbs. Cut-off at ¼. 5000 horses. Propeller engines at 42 revolutions and 16 lbs. pressure. Cut-off at ¾. 5000 horses.

Boilers proved with a cold pressure of 50 lbs. Each set of boilers has an independent steam engine (donkey). There are two auxiliary engines for hoisting, pumping, &c. Area of canvass, 6500 square yards. Chains, cables, $2\frac{7}{8}$ inches diameter. Anchors, chains, and capstans, 250 tons.

| | |
|---|---|
| Weight of propeller, . . | 36 tons. |
| " " shaft, . | 60 " |
| " rudder stock (18 ins. diameter), | 22 " |

Two propeller steamers swung at sides, abaft of wheel-house, of 120 tons burthen each.

Accommodation.—1st class passengers, 800. 2d class passengers, 2000. 3d class passengers, 1200.

*Result of trial trip.*—Draft of water, forward 22 feet 2 ins.; aft, 25 feet—mean, 23 feet 7 inches.

Water-wheel engines: pressure of steam, 15·5 lbs. Cut-off at $\frac{4}{11}$ lbs. of stroke. 11 to 11·5 revolutions. Indicated power, 3330 horses.

Propeller engines: pressure of steam 16 lbs. Cut-off at $\frac{3}{4}$ of stroke. 41 revolutions. Indicated power, 4800 horses.

Speed: with jib and fore spankers set, having an area of canvass of 2500 yards, 14·5 knots.

Consumption of fuel: 3·5 lbs. per horse power per hour.

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For the Journal of the Franklin Institute.

## *Particulars of the Steamer Adriatic.*

This steamer having lately been purchased by the North Atlantic Steamship Company, is being fitted for sea, and at the same time her accommodations for passengers have been so altered as to meet the requirements of the new and particular service for which she is intended.

The essential modification regarding the hull is the addition of a deck extending to the line of her rail, but not enclosed at the sides beyond the line of saloon, officers' state rooms, &c. Regarding the engines, an alteration in the operation of the valves is being made by the Novelty Iron Works—a trial of the engine will be made very shortly, and so soon as approved of she will be put upon the route between New York and Aspinwall.

Hull built by James and George Steers. Machinery by Novelty Iron Works, New York.

HULL.—

| | | | |
|---|---|---|---|
| Length over all, . . . | 351 | feet | 8 inches. |
| Length on deck, from fore part of stem to after part of stern post, above the spar deck, . . | 344 | " | 6 " |
| " at load line, . . . | 343 | " | 10 " |
| Breadth of beam at midship section, *molded*, . | 48 | " | 8 " |
| " " " *extreme*, . | 50 | " | |
| Depth of hold, . . . | 25 | " | |
| " to spar deck, . . . | 33 | " | 2 " |
| Length of engine and boiler space, including side bunkers, | 130 | " | |
| Tonnage, custom-house, . . 4144. | | | |

ENGINES.—Description of engines—Oscillating.

| | | |
|---|---|---|
| Diameter of cylinders, | | 101 inches. |
| Length of stroke, | 12 feet. | |
| Maximum pressure of steam in pounds, | 26. | |
| " revolutions per minute, | 14. | |
| Point of cutting-off, | one-half. | |
| Draft of water at above pressure and revolutions, | 18 " | 6 " |
| Area of immersed midship section at load draft, | 880 " | |
| Diameter of paddle-wheels, | 40 " | |
| Length of blades, | 12 " | |
| Depth " | 3 " | |
| Number " | 32. | |
| Area of blade surface, | 2144 " | |

BOILERS.—Description of boilers—Vertical tubular.

| | | |
|---|---|---|
| Number of boilers, | 8. | |
| Length " | 20 feet | 1½ inches. |
| Breadth " | 11 " | 3 " |
| Height " exclusive of steam chimney, | 14 " | |
| Number of furnaces, | 48. | |
| Width " | 2 " | 9 " |
| Length of grate bars, | 8 " | |
| Number of tubes, | 13,064. | |
| Diameter " external, | | 2 " |
| Length " | 8 " | |
| Diameter of smoke pipes, (two,) | 7 " | |
| Height " | 40 " | |
| Heating surface (fire and flues), | 30,758 sq. ft. | |
| Combustion, | Natural draft. | |
| Capacity of coal bunkers, in tons of coal, | 1200. | |
| Consumption of coal per hour, | 4 tons. | |
| Draft of water at load line, | 20 " | |
| " " light " | 17 " | 1½ " |
| Displacement " " | 5233 tons. | |
| Weight of engines, *in pounds*, | 825,000. | |
| " boilers, without water, | 836,232. | |
| " water in boilers, | 1,075,200. | |
| Floor timbers at throats, *molded*, | | 22 " |
| " " *sided*, | 13 and 16 " | |
| Distance of frames *apart at centres*, | 33 and 36 " | |
| Frame strapped with diagonal and double laid iron straps, | ⅞ by 5 " | |
| Masts and rig—Brig. | | |
| Intended service, | New York to Aspinwall. | |
| Description of coal, | Anthracite or Bituminous. | |

*Memoranda.*—Launching draft, 10 feet 2 ins. Weight of hull, 2041 tons. Weight of engines, boilers, water, coal, spars, &c., 2400 tons. Average displacement per inch from launching draft to light load line (17 feet 1½ ins.), 26·43 tons. Average displacement per inch from light load line to load line (20 feet), 28·75 tons. Average displacement per inch from load line to 21 feet 6 ins., 31·5 tons.

Piston rod 14 inches in diameter. Shafts 26·5 inches in diameter. Air-pump 42 inches in diameter by 5 feet stroke of piston. Condensers, Pirsson's fresh water, having 24,000 square feet of surface. Diameter of tubes, ¾-inch, of No. 17 wire gauge.

Accommodations—Cabin passengers, 350; 2d cabin, 200; Steerage passengers, 1000. Freight, 800 tons measurement. C. H. H.

## *On the Manufacture of Malleable Iron and Steel.**

By Mr. HENRY BESSEMER.

[From a Paper read before the Institution of Civil Engineers, London.]

Attention was directed, in the early part of the Paper, to the ordinary mode of manufacturing iron by the puddling process; in the course of which the iron, after it "came to nature," was gathered into balls, and was then removed, as quickly as possible, to the squeezer, where much of the fluid scoria, with other mechanically mixed impurities, was driven out, leaving a mass or billet of iron, composed of thousands of separate fragments of metal, the entire surface of every one of which was, more or less, coated with dry oxide, or fluid silicate of the oxide of iron. The great pressure exerted by the squeezer sufficed to so far remove the fluid coating of the contiguous particles as to bring their surfaces into actual contact, and consequently to effect an union at such parts. But the whole of the matter thus displaced could not find its way between the interstices of the mass, and therefore it became locked in its numerous cavities, producing points of weakness and separation in the metal. No amount of after working, or rolling, could wholly displace the portions of cinder, dry oxide of iron, and of sand, which thus became mixed up with and were diffused throughout the mass, causing flaws and cracks in the iron, all, more or less, objectionable.

Now, if these imperfections were the natural and inevitable consequences of the conditions under which malleable iron was at present produced, it followed that defects of a similar character must also of necessity exist in steel, produced by the puddling process. The granular condition of the metal and its exposure to heat and oxygen, could not fail, in both cases, to oxidize the entire surfaces of the numerous molecules to be united into one mass; the admixture of scoria and other matters, from the furnace, was equally certain to result; and also the difficulty of bringing each particle of the metal to the same degree of decarbonization and refinement existed as in the making of iron, with the additional inconvenience arising from some portions of the metal becoming entirely decarbonized, and being converted into soft malleable iron.

Iron thus presented a most unfavorable contrast with the other malleable metals, all of which were free from sand or scoria; they had no hard and soft parts, and required no welding together of separate molecules, but they were perfectly homogeneous, and free from all mechanical admixture with foreign substances. Gold, silver, copper, zinc, tin, and lead, owed this valuable exemption from the defects universally found in puddled iron, simply to the fact that they were purified and refined in a fluid state, and while still fluid were formed into ingots, whereby the cohesion of every particle in the mass was insured. If, then, the refining of other malleable metals, while in a fluid state, and their formation into cast ingots, rendered all such metals more sound and homogeneous than iron, while it did not lessen their extreme ductility, why should iron for ever remain an exception to the general

* From the Lond. Artizan, July, 1859.

rule? It might be truly answered, that hitherto the excessively high temperature required to fuse and to maintain pure iron in a fluid state, had interposed an insuperable barrier, for the highest heat of the furnaces only sufficed to show that fluidity was a possible condition of that metal.

It need not, therefore, be a matter of surprise, that when Mr. Bessemer first proposed to convert crude pig iron into malleable iron, while in a fluid state, and to retain the fluidity of the metal, for a sufficient time to admit of its being cast into moulds, without the employment of any fuel in the process, his proposition was looked upon by many as a chimera, or as the mere day dream of an enthusiast; but it was nevertheless fully recognised and supported by many of the scientific men of the day. The same deep conviction of the truth on which the new process was based, and which led Mr. Bessemer to bring it before the British Association, in 1856, had since determined him (in spite of the opinions then pronounced against the process) to pursue one undeviating course until the present time, and to remain silent for years, under the expressed doubts of those who predicted its failure, rather than again bring forward the invention until it had been practically and commercially worked; and there had been produced by it both iron and steel, of a quality which could not be surpassed by any iron or steel made by the tedious and expensive process now in general use.

The want of success which attended some of the early experiments was erroneously attributed, by some persons, to the "burning" of the metal, and by others to the absence of cinder, and to the crystalline condition of cast metal. It was almost needless to say, that neither of the causes assigned had any thing to do with the failure of the process, in those cases where failure had occurred. Chemical investigation soon pointed out the real source of difficulty. It was found that, although the metal could be wholly decarbonized, and the silicum be removed, the quantity of sulphur and of phosphorus was but little affected; and as different samples were carefully analyzed, it was ascertained that red shortness was always produced by sulphur, when present to the extent of $\frac{1}{10}$th per cent., and that cold shortness resulted from the presence of a like quantity of phosphorus; it, therefore, became necessary to remove those substances. Steam and pure hydrogen gas were tried, with more or less success, in the removal of sulphur, and various fluxes, composed chiefly of silicates of the oxide of iron and manganese, were brought in contact with the fluid metal, during the process, and the quantity of phosphorus was thereby reduced. Thus many months were consumed in laborious and expensive experiments; consecutive steps in advance were made, and many valuable facts were elicited. The successful working of some of the higher qualities of pig iron caused a total change in the process, to which the efforts of Messrs. Bessemer and Longsdon were directed. It was determined to import some of the best Swedish pig iron, from which steel of excellent quality was made, and tried for almost all the uses for which steel of the highest class was employed. It was then decided to discontinue, for a time, all fur-

ther experiments, and to erect steel works at Sheffield, for the express purpose of fully developing and working the new process commercially, and thus to remove the erroneous impressions so generally entertained in reference to the Bessemer process.

In manufacturing tool steel of the highest quality it was found preferable, for several reasons, to use the best of Swedish pig iron, and, when converted into steel by the Bessemer process, to pour the fluid steel into water, and afterwards to re-melt the shotted metal in a crucible, as at present practised in making blister steel, whereby the small ingots required for this particular article were more perfectly and more readily made.

It was satisfactory to know that there existed in this country vast, and, apparently, inexhaustible beds of the purest ores, fitted for the process. Of the hematite alone, 970,000 tons were raised annually, and this quantity might be doubled or trebled, whenever a demand arose. It was from the hematite pig iron, made at the Workington Iron Works, that most of the larger samples of iron and steel exhibited were made. About 1 ton 13 cwt. of ore, costing 10s. per ton, would yield 1 ton of pig metal, with 60 per cent. less lime, and 20 per cent. less fuel, than were generally consumed when working inferior ores; while the furnaces using this ore alone yielded from 220 to 240 tons per week, instead of, say 160 to 180 tons per week when working with common iron-stone. The Cleator Moor, the Weardale, and the Forest of Dean Iron Works, also produced an excellent metal for this purpose.

The form of converting-vessel, which had been found most suitable, somewhat resembled the glass retort used by chemists for distillation. It was mounted on axes, and was lined with "ganister," or road drift, which lasted during the conversion of thirty or forty charges of steel, and was then quickly and cheaply repaired or renewed. The vessel was brought into an inclined position, to receive the charge of crude iron, during which time the tuyeres were above the surface of the metal. As soon as the whole charge was run in, the vessel was moved on its axes, so as to bring the tuyeres below the level of the metal, when the process was at once brought into full activity, and twenty small, though powerful jets of air sprung upwards through the fluid mass; the air expanding in volume, divided itself into globules, or burst violently upwards, carrying with it a large quantity of the fluid metal, which again fell back into the burning mass below.

The oxygen of the air, appeared in this process, first to produce the combustion of the carbon contained in the iron, and at the same time to oxidize the silicum, producing silicic acid, which uniting with the oxide of iron, obtained by the cumbustion of a small quantity of metallic iron, thus produced a fluid silicate of the oxide of iron or "cinder," which was retained in the vessel, and assisted in purifying the metal. The increase of temperature which the metal underwent, and which seemed so disproportionate to the quantity of carbon and iron consumed, was doubtless owing to the favorable circumstances under which combustion took place. There was no intercepting material to

absorb the heat generated, and to prevent its being taken up by the metal, for heat was evolved at thousands of points, distributed throughout the fluid, and when the metal boiled, the whole mass rose far above its natural level, forming a sort of spongy froth, with an intensely vivid combustion going on in every one of its numberless, ever-changing cavities. Thus, by the mere action of the blast, a temperature was attained in the largest masses of metal, in ten or twelve minutes, that whole days of exposure in the most powerful furnace would fail to produce.

The amount of decarbonization of the metal was regulated, with great accuracy, by a metre, which indicated on a dial the number of cubic feet of air that had passed through the metal; so that steel of any quality or temper could be obtained with the greatest certainty. As soon as the metal had reached the desired point (as indicated by the dial), the workmen moved the vessel, so as to pour out the fluid malleable iron, or steel, into a founder's ladle, which was attached to the arm of a hydraulic crane, so as to be brought readily over the moulds. The ladle was provided with a fire-clay plug at the bottom, the raising of which, by a suitable lever, allowed the fluid metal to descend in a clear vertical stream into the moulds. When the first mould was filled, the plug valve was depressed, and the metal was prevented from flowing until the casting ladle was moved over the next mould, when the raising of the plug allowed this to be filled in a similar manner, and so on, until all the moulds were filled.

The casting of large masses of a perfectly homogeneous malleable metal into any desired form rendered unnecessary the tedious, expensive, and uncertain operation of welding now employed wherever large masses were required. The extreme toughness and extensibility of the Bessemer iron was proved by the bending of cold bars of iron, 3 ins. square, under the hammer into a close fold, without the smallest perceptible rupture of the metal at any part; the bar being extended on the outside of the bend from 12 inches to $16\frac{3}{4}$ inches, and being compressed on the inside from 12 inches to $7\frac{1}{4}$ ins., making a difference in length of $9\frac{1}{2}$ ins. between what, before bending, were the two parallel sides of a bar 3 ins. square. An iron cable, consisting of four strands of round iron, $1\frac{1}{2}$ ins. diameter, was so closely twisted, while cold, as to cause the strands at the point of contact to be permanently imbedded into each other. Each of these strands had elongated $12\frac{1}{2}$ inches in a length of 4 ft., and had diminished one-tenth of an inch in diameter, throughout their whole length. There were also exhibited some steel bars, 2 ins. square, and 2 ft. 6 ins. in length, twisted cold into a spiral, the angles of which were about 45 degrees; and some round steel bars, 2 ins. in diameter, bent cold under the hammer, into the form of an ordinary horse-shoe magnet, the outside of the bend measuring 5 ins. more than the inside.

The steel and iron boiler plates, left without shearing, and with their ends bent over cold, also afforded ample evidence of the extreme tenacity and toughness of the metal; while the clear even surface of the railway axle and piece of malleable iron ordnance were examples

of the perfect freedom from cracks, flaws, or hard veins, which formed so distinguishing a characteristic of the new metal. The tensile strength of this metal was not less remarkable, as the several samples of steel tested in the proving-machine, at Woolwich Arsenal, bore, according to the reports of Colonel Eardley-Wilmot, R. A., a strain varying from 150,000 lbs. to 162,000 lbs. on the square inch, and four samples of iron boiler-plate from 68,314 lbs. to 73,100 lbs; while, according to the published experiments of Mr. W. Fairbairn, Staffordshire plates bore a mean strain of 45,000 lbs., and Low Moor and Bowling plates, a mean of 57,120 lbs. per square inch.

There was also another fact of great importance in a commercial point of view. In the manufacture of plates for boilers and for ship-building, the cost of production increased considerably with the increase of weight in the plate; for instance, the Low Moor Iron Company demanded £22 per ton for plates weighing 2½ cwt. each, but if the weight exceeded 5 cwt., then the price rose from £22 to £37 per ton. Now, with cast ingots, such as the one exhibited, and from which the sample plates were made, it was less troublesome, less expensive, and less wasteful of material, to make plates weighing from 10 to 20 cwt. than to produce smaller ones, and indeed there could be but little doubt that large plates would eventually be made in preference, and that those who wanted small plates would have to cut them from the large ones. A moment's reflection would therefore show the great economy of the new process, in this respect; and when it was remembered that every riveted joint in a plate reduced the ultimate strength of each 100 lbs. to 70 lbs., the great value of long plates for girders and for ship-building would be fully appreciated.

At a time when the manufacture of ordnance occupied so large a share of public attention, it was interesting briefly to point out the great facility which the Bessemer process afforded of forming masses, both of malleable iron and of steel, of a size suitable for the heaviest ordnance, without any welding together of separate slabs, or the more costlier mode of building up the gun with pieces accurately turned and fitted together. Many attempts have been made to produce wrought iron ordnance, and this object had been successfully accomplished in the case of the large gun produced at the Mersey forge. But, however perfect this one gun might be, the time required to make it, and its immense cost, manifestly rendered it still a great desideratum to produce guns rapidly and cheaply of a material equal to or greater in tensile strength than wrought iron, and, if possible, free from the liability which that material had to flaws and to deterioration, during its long exposure to a welding heat. It was believed that the Bessemer process supplied this desideratum, as masses of cast malleable metal could be produced of 10 to 20 tons in weight in a single piece, and two or three such pieces might be conveniently made by the same apparatus in one day. The metal so made might be either soft malleable iron or soft steel. In order to prove the extreme toughness of such iron, and the strain to which it might be subjected without bursting, several cast and hammered cylinders were placed cold under the steam-hammer,

and were crushed down without the least tearing of the metal, as was shown by the samples exhibited. These cylinders were drawn from a round cast iron ingot of only 2 ins. greater diameter than the finished cylinder, and in the precise way in which a gun would be treated; they might, therefore, be considered as short sections of an ordinary 9-pounder field-piece. The tensile strength of the samples, as tested at the Royal Arsenal, was 64,566 lbs. per sq. in., while the tensile strength of pieces cut from the Mersey gun gave a mean of 50,624 lbs. longitudinally, and 43,339 lbs. across the grain; thus showing a mean of 17,550 lbs. per sq. in. in favor of the Bessemer iron.

If it was desired to produce ordnance by merely casting the metal, the ordinary founding process might be employed with the simple difference, that the iron, instead of running direct from the melting furnace into the mould, must first be run into the converting vessel, where in ten minutes it would become steel, or malleable iron, as was desired, and the casting might then take place as in the ordinary manner. The small piece of ordnance exhibited served to illustrate this important manufacture; and it was interesting, in consequence of its being the first gun that was ever made in malleable iron without a weld or joint. The importance of this fact would be enhanced when it was known that conical masses of this pure tough metal, of from 5 to 10 tons in weight, could be produced at Woolwich at a cost not exceeding £6 12s. per ton, inclusive of the cost of pig iron, remelting, waste in the process, labor, and engine power. The conical ingots being cast in iron moulds, the great delay in moulding in loam would be avoided; and as the iron moulds employed might be removed from the casting-pit within an hour after the metal had been poured into them, the tedious interval of three days now required by the cast iron guns before removal would be also avoided, thus immensely increasing the capabilities of the foundry.

If it was assumed that these advantages were about equal to the cost of hammering the cast ingot, then, by this process, it would be practicable to produce guns of any size, in hammered cast steel, or malleable iron, ready for the boring mill, at about the same cost as the cast iron guns now in use; but if the weight of the guns could be reduced by 20 or 25 per cent., in consequence of their superior strength, then an actual saving in that proportion would be effected in the first cost of every gun so made. These important facts had been laid before the government, and their advantages were stated to be fully appreciated by Colonel Eardley-Wilmot, the Superintendent of the Royal Gun Factories, who had evinced a great interest in the progress of the invention from its earliest date, and to whose kindness the author was indebted for the many valuable trials of the tensile strength of the various samples of metal that have been submitted for investigation.

It would be interesting to those who were watching the advancement of the new process to know that it was already rapidly extending itself over Europe. The firm of Daniel Elfstrand & Co., of Edsken, who were the pioneers in Sweden, had now made several hundred tons of excellent steel by Bessemer's process. Another large manufactory had

since been started in their immediate neighborhood, and three other companies were also making arrangements to use the process. The authorities in Sweden had fully investigated the whole process, and had pronounced in favor of it. The large steel circular saw plate exhibited was made by Mr. Göranson, of Geffle, in Sweden, the ingot being cast direct from the fluid metal, within fifteen minutes of its leaving the blast furnace. In France, the process has been for some time carried on by the old established firm of James Jackson & Son, at their steel works, near Bordeaux. This firm was about to manufacture puddled steel on a large scale. They had already got a puddling furnace erected and in active operation, when their attention was directed to the Bessemer process, the apparatus for which was put up at their works last year; and they were now extending their field of operations by putting up more powerful apparatus at the blast furnaces in the Landes. There were also four other blast furnaces in the south of France in course of erection, for the express purpose of carrying out the new process.

The irons of Algeria and Saxony had produced steel of the highest quality.

Belgium was not much behind her neighbors; the process was now being carried into operation at Liege, where excellent steel had been made from the native coke iron; while in Sardinia preparations were also being made for working the system. Russia had sent to London an engineer and a professor of chemistry to report on the process, and Professor Müller, of Vienna, and M. Dumas and others from Paris, had visited Sweden, to inspect and report on the working of the new system in that country.

The Bessemer process might therefore be now fairly considered an accomplished commercial fact, and in a country like England, where the manufacture of iron and steel formed so important a branch of the national industry, and was so necessary an element in all the great manufacturing operations, it must be admitted that an impartial examination of the new system was of the highest importance, not only to those immediately concerned in the production of malleable iron and steel, but to the country generally.

That the process admitted of further improvement, and of a vast extension beyond its present limits, the author had no doubt; but those steps in advance would, he imagined, result chiefly from the experience gained in the daily commercial working of the process, and would most probably be the contributions of the many practical men who might be engaged in carrying on the manufacture of iron and steel by this system. Hitherto the process had been brought into its present practical and commercial state, without recourse to any of the numerous inventions which were supposed by the several authors to be essential to the success of the system; but any real improvement that might be brought forward would be cordially received and encouraged.

### *Jensen's Marine Engine Governor.**

At the Institution of Mechanical Engineers, on Wednesday, the 4th of May, a paper was read by Mr. Henry Maudslay, descriptive of this apparatus, the object of which is to prevent the engine from running off at an excessive speed, when the resistance of the water is suddenly removed by the pitching or rolling motion of the vessel in stormy weather. This governor consists of a cylinder, A, at the bottom of which a communication or opening, B, is made through the side of the vessel, as near as possible to the propeller or paddle wheel; in this

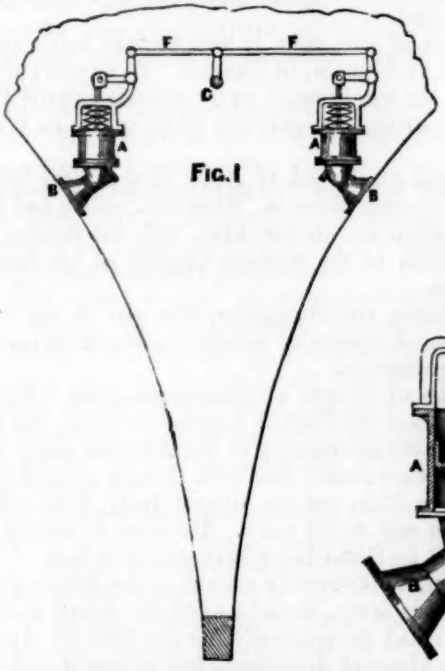


FIG. 1

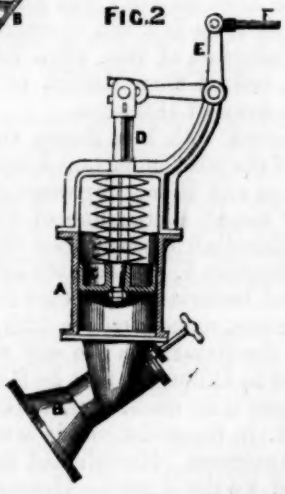


FIG. 2

cylinder a piston, C, works, attached to the piston rod, D, which is connected by means of bell-cranks, E, and rods, F, with the spanner or lever arm, G, of the throttle valve in the steam-pipe of the engine. When the motion of the vessel causes the propeller to be less deeply immersed, the pressure of water in the cylinder, A, is diminished, the piston, C, of which is forced down by the spring above, thereby closing the throttle valve to the required extent, and preventing the speed of the engine from increasing; also, when the propeller is more deeply immersed, the pressure in the cylinder, A, is increased, and raises the piston, C, opening the throttle valve, and admitting more steam to the engine, so as to maintain the required speed: the object being to control the speed of the engine before it has time to sensibly change,

* From the Lond. Artizan, June, 1859.

instead of waiting for a change to bring the governor into action. Fig. 1 is a view of the apparatus as applied to a vessel; the apparatus is shown in Fig. 2 detached and to an enlarged scale.

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### *The Origin of the Electric Telegraph.**

Dr. Hamel, of the Imperial Academy of Sciences at St. Petersburg, who has communicated to that Academy the results of his laborious researches regarding the early history of the Electric Telegraph, shows how the construction of the very first telegraph, worked by a galvanic battery, originated.

On the 6th of August of this year, it will be just half a century since it was completed at Munich, in Bavaria. It appears that an event in connexion with the war brought on by Austria against France fifty years ago, in 1809, caused the galvanic telegraph to be invented and made.

The Austrian army had on the 9th of April in that year begun to cross the river Inn, and to enter Bavaria. King Maximilian had hardly been informed of this, when he, on the 11th, with his family, in all haste, retired from Munich to the western frontier of his kingdom, to the town of Dillingen.

He took with him Baron von Montgelas, who was at the head of two of the most important branches of administration in Bavaria, the Foreign and Home Departments.

By means of the line of Chappe's optico-mechanical telegraphs, established all the way from the French frontier to Paris, the Emperor Napolean I. got there the information of the Austrian army having entered Bavaria much sooner than it had been thought possible by the Bavarians, namely on the 12th, and he, without delay, departed from Paris for Bavaria on the way to his army. He came so totally unexpected to Dillingen, that he found King Maximilian in bed.

There is no doubt that, to the speedy arrival of the Emperor Napolean I. in the midst of his army, Bavaria owed its deliverance from the Austrians. Munich had been already, on the 16th of April, occupied by the Austrian General Jellachich, but he was in less than a week after, on the 22d, obliged to withdraw, and King Maximilian was again able to enter into his capital.

This event, so vitally important for Bavaria and Munich, must there have directed a special attention to the utility of telegraphs.

Baron Montgelas had been witness of the surprise caused by the French Emperor's unexpected arrival at Dillingen. Under his extensive administration was also the Munich Academy of Sciences. Dr. Samuel Thomas von Soemmerring, the well known anatomist and physiologist, who had been since 1805 a member of that Academy, was from time to time invited to come to dine with the minister Montgelas at Bogenhausen, near Munich, where he lived. This was the case on the 5th of July, 1809, when the minister expressed to him the wish to

* From the Journal of the Society of Arts, No. 338.

get from the Academy of Sciences proposals for telegraphs, having, it is to be supposed, in view no other but improved optical or mechanical telegraphs.

Soemmerring, who had, like Humboldt, very early paid attention to galvanism, in hopes of being able to make its study useful to clear up some of the most mysterious portions of physiology, and who also had now closely followed and noted the brilliant chemical discoveries made by Davy with the galvanic battery in the laboratory of the Royal Institution in London, at once resolved to try whether the evolution of gases from the decomposition of water by the action of the galvanic current might not be applied to telegraphic purposes.

From the time of the above mentioned dinner at the minister's, he gave himself no rest in his endeavors to construct a galvano-chemical telegraph.

On the 6th of August he considered the object of his ardent desire attained. He noted that day: "Tried the entirely finished instrument, which completely answers my expectations." He was then able to work with the telegraph he had invented through 724 feet of wire. Twelve days later he telegraphed through no less than 2000 feet, and on the 29th of August, he exhibited his telegraph in action before a meeting of the Academy of Sciences.

He now wished to send his instrument to the National Institute in Paris. On the 4th of November, the chief surgeon of the French army, Dominique Jean Larrey, with whom Soemmerring had been long acquainted, came to Munich on his way to Paris from the army, after the battles of Aspern, Esslingen, and particularly at Deutsch Wagram, where Napoleon I. had on the field created him a Baron. Larrey most readily offered to take the telegraph with him, and even assisted at the packing of it.

After his departure, Soemmerring composed a French memoir, describing his invention, which he forwarded to Larrey, in Paris, with a letter, wherein he expressed his hope that he would also exhibit the telegraph to the Emperor.

Dr. Hamel has ascertained in Paris, that Larrey presented Soemmerring's telegraph to the Institute on the 4th of December (1809), and that Biot, Carnot, Charles and Monge were appointed to report on it.

Soemmerring to his great delight, succeeded in accomplishing on the 23d of August, 1810, his very ingenious mechanical contrivance for causing the gas bubbles rising from the wire-points in the water to ring an alarm bell.

Ten days previous to that, on the 13th of August, Baron Schilling, then attached to the Russian Mission at Munich, saw for the first time Soemmerring's telegraph. He became enthusiastically fond of the new art of signalizing, which promised to become so all-important, and he directed the attention of many other persons to it. In 1811 he introduced to Soemmerring, Colonel Count Jeroslas Potocky, who took a telegraph made for him to Vienna, and exhibited it on the 1st of July to the Emperor Francis I., in the presence of the Empress and

the Archdukes Charles and John. His Majesty expressed the wish to have a telegraphic communication established between Vienna, and his country palace Laxenburg, a distance of nine miles. Baron Schilling was, as stated in the *Journal* a short time since,* the medium by which the British Envoy and Minister Plenipotentiary at Munich, the Honorable Frederic James Lamb, brother to Lady Palmerston, and subsequently the second Lord Melbourne, on the 12th of July, 1816, witnessed experiments with Soemmerring's instrument, being the first Englishman who ever saw a galvanic telegraph.

Again, Baron Schilling was the person who, at a later period, made in St. Petersburg the first electro-magnetic telegraph, which he, in 1835, two years before his death, exhibited to the meeting of the German naturalists at Bonn. Dr Hamel has explained to the St. Petersburg Academy, in detail, how Baron Schilling's telegraphic contrivance found, in 1836, its way from the borders of the Rhine to England, and so gave the impulse to the spreading of that most wonderful application of science, by means of which, ere long, all inhabited parts of the globe will be put in telegraphic intercommunication.

*Journal of the Society of Arts, Vol. VII, p. 235.

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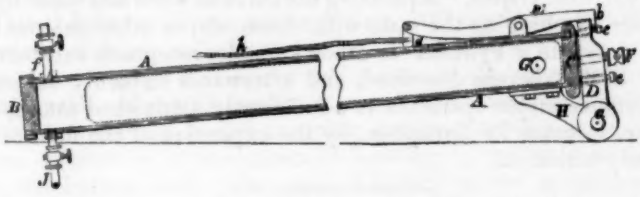
*An improved method of effecting the separation of the fibres of wood, for the manufacture of paper therefrom, which is also applicable to the separation of the fibres of flax or other substances for the manufacture of textile fabrics, and also to the separation of other substances for similar or other purposes,—being a Communication.* Patented by WILLIAM EDWARD NEWTON.* Dated London, June 21st, 1858.

It is well known that the fibres of most kinds of wood are arranged in the form of very minute tubes, in which the sap circulates. Now the improved method of separating these fibres, constituting this invention, consists in subjecting the wood, while in a strong cylinder or box, to the action of steam, air, gas, hot water, or other fluid, under a high pressure, for the purpose of charging its tubes, as well as the spaces between them, and then causing it to be suddenly projected from the cylinder or box into the atmosphere or into a partial vacuum, where, by the expansive force acting within and upon the tubes, they will burst open, and cause the complete separation of the fibres. The same process applies to the separation and opening of flax and other analogous fibrous materials.

The figure exhibits a longitudinal central section of a cylinder, or, as (from its operation) it may be termed, a gun, for effecting the separation of the fibres of wood preparatory to their conversion into paper pulp. This gun may be of any suitable length and calibre, and composed of a piece or pieces of lap-welded iron tubing A, permanently closed at one end with a stopper B, and at the other end fitted with a movable head or cap C. The cap is to be fitted after the fashion of a valve, or with a suitable packing to be capable of making a steam-

*From Newton's London Journal, April, 1859.

tight joint. In order to secure this cap C, firmly in place, and thereby close the gun, a bracket-arm H, is bolted to one side of the gun, for the purpose of carrying by a hinge-joint *a*, a strong lever D, which is capable of being brought to a position across the cap C, and secured in that position by a hook *b*, at one end of the lever E, which is attached to the gun on the opposite side to that of the hinge-joint *a*, of the first lever by a fulcrum pin *c*. The other end of the lever E has hinged to it a prop piece *d*, which, when resting upon the side of the gun, secures the hook *b*, upon the lever D. F, is a screw, working in the lever D, for the purpose of securing the cap closely to the mouth or muzzle of the gun; and *e*, *e*, are screw-bolts, which attach the cap loosely to the lever D. G, is a steam-pipe, for admitting steam from a boiler to the gun next the cap C. This pipe should be furnished with a stop-cock or valve. *f*, is the pipe at the other end of the gun, for the escape of air when the steam is admitted. *j*, is a pipe, for allowing any water to run back from the gun to the boiler when desired.—This gun is to be placed in a slightly inclined position, so that a small



quantity of water may settle near the breech, and should either be mounted in a very strong frame, capable of sustaining it against recoil, or be otherwise supported at its breech for that purpose. The wood may be put in, either in the form of a log, as large as can be conveniently inserted, or in smaller pieces, and in any case the gun may be nearly filled with it, provided that a space be left near the breech for the collection of a small quantity of water. It is better that the wood should be cut while green, and, before being put in the gun, it should be soaked in water for several days, or till the sap is displaced by the water. When the wood has been put in, the lever D, is brought up and secured by bringing down the hook *b*, of the lever E, upon it, and by setting up the prop piece *d*, of the latter lever; and the screw F, is then screwed up to close the cap C, tightly. The next thing to be done is to expel the air from the gun, which is done by opening the stop-cock in the pipe *f*, and admitting steam slowly from the boiler by the pipe G, till it issues copiously from the air escape-pipe *f*, when the latter may be closed entirely, and steam admitted freely by the steam-pipe. The temperature in the boiler should be about 390° Fahr., which will give a pressure of above two hundred pounds per square inch. After steam has been admitted to the gun for a few minutes, the temperature of all the water that remains in the wood, not displaced by the steam or converted into steam, will be the same as that in the boiler; and a quantity of water that will have been collected in the lowest part of the gun, by reason of the condensation of the steam

in contact with the interior surface of the gun, and by the expulsion from the wood, will be of the same temperature also. The cap may then be set free, by an attendant, standing some distance behind the muzzle, tripping up the prop piece *d*, by pulling a string *h*, attached thereto, and depressing the rear end of the lever E. The hook *b*, will thus be raised from the lever D, and the pressure of the confined steam will force off the cap C. The steam, which is instantly generated from the water in the rear portion of the gun, by the reduction of the pressure, will force the wood out of the gun, and as it emerges, the expansion of the steam in and among its tubes, and the instantaneous flashing into steam of a portion of water remaining in it, will effect a perfect separation of its fibres, leaving them in a state in which they may either at once, or after bleaching, be introduced to the pulp-mill or other machinery for their reduction into pulp, or into a suitable state for conversion into paper. The fibres, it may be stated, though scattered about, are nearly all left within seventy or eighty feet from the muzzle of the gun, and may be collected without difficulty.

The patentee claims, "separating the fibres of wood and other fibrous substance by charging the same with steam, air, or other gaseous body or hot water, in a cylinder or other suitable receptacle substantially similar to that herein described, and afterwards suddenly subjecting the substance under operation to a sufficiently diminished atmospheric pressure, to cause its disruption, by the expansion of the fluid or gaseous body within it."

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### *On a New Method of Manufacturing Ammonia.**

By ALEXANDER WILLIAMS, Neath.

The importance of ammonia and its sister compound, nitric acid, in an agricultural point of view, as forming probably the chief sources whence the nitrogen of plants is obtained, and the high commercial price of compounds containing either of these substances, have led practical chemists to look upon any new method of obtaining them as one of the great desiderata of the day.

The atmosphere, with its water, contains the elements necessary for the formation both of ammonia and nitric acid, and during the passage of electricity both are formed; but so far as our present knowledge extends, and from a long series of experiments on the subject, I am led to believe that it will be some time ere the Society's premium will be claimed "for the production of ammonia or nitric acid *from their elements*, by methods which would admit of practical application."

After having been engaged for many years in experiments on this subject, I have arrived at the conclusion that, except under peculiar circumstances, nitrogen and hydrogen in their gaseous or elementary state, will not combine together in sufficient quantities to be commercially available. To make them unite in any quantity it is necessary that the nitrogen should, in its nascent state, be brought in contact

*From the Journal of the Society of Arts, No. 339.

with the hydrogen, when union will take place, but this combination is much more readily effected if both be in their nascent state.

To obtain nascent nitrogen it is, of course, necessary to decompose one of its compounds, and thus far I had only arrived at the same conclusion as every one else. The object of this paper is to direct attention to a bye-product of one of our most important chemical manufactories, which is exactly adapted for our purpose.

The animal and vegetable kingdoms have been so thoroughly searched by the shoals of manure manufacturers of this and other countries, that the discovery of any new nitrogen compound in these kingdoms seems to be altogether improbable; one is therefore naturally led to the mineral kingdom, and our ideas as naturally become fixed on nitrate of soda as the cheapest source. It has been known for years that nitric acid, or other compounds of nitrogen and oxygen, could be converted into ammonia, and therefore the use of a nitrate would present no novelty; but if we can obtain the nascent nitrogen from nitrate of soda as a bye-product, we shall have made a grand step towards facilitating the manufacture of ammonia.

This, I believe, I have accomplished. Of the thousands of tons of nitrate of soda annually imported into this country, I have been told, on good authority, that about half is used in the manufacture of sulphuric acid. It is well known that sulphuric acid is usually manufactured in a large leaden chamber having attached to it a burner where sulphur is kept constantly burning, by which it is converted into sulphurous acid. The great difficulty of the manufacture is to give another atom of oxygen to this sulphurous acid ( $S O_2$ ) to convert it into sulphuric acid ( $S O_3$ ), and it is for this purpose that the nitrate of soda (cubic nitre) is used, and usually in the following manner:—one or more movable iron pots are placed in the burner. Into each of these pots is put, as often as required, a few pounds of nitrate of soda, and with it a sufficient quantity of sulphuric acid to decompose it. Sulphate of soda (salt cake) remains in the pot, whilst nitric acid and probably other compounds of nitrogen and oxygen pass with the sulphurous acid into the leaden chamber. The sulphurous acid ( $S O_2$ ) gains an additional atom of oxygen from the nitrogen compounds, and becomes converted into sulphuric acid ( $S O_3$ ) which, with water afforded by steam jet or otherwise, condenses as a liquid at the bottom of the chamber, whilst a quantity of gas escapes.

Such is a rough sketch of the first part of the process usually adopted for making sulphuric acid or oil of vitriol, and the gas which escapes from the vitriol chamber must now be the subject of our inquiry.

On referring to Dr. Ure, our great authority on manufacturing chemistry, I found that he asserts that in a properly working chamber nothing but nitrogen gas should escape; in fact, that the whole of the oxygen should be taken up, and that the nitrogen should be reduced to its elementary condition. This, although the generally received opinion of the manufacturing chemists of the present day, appeared to me fallacious; as, on considering the affinities, I did not think it

probable that sulphurous acid, although it is known to form a compound with nitric oxide ( $N O_2$ ), should, under the circumstances occurring in the vitriol chambers, be able to decompose it. Experiments were immediately instituted to ascertain the truth, and they led to the knowledge of the fact that a chemical compound of nitrogen and oxygen was escaping, and not free nitrogen. What particular compound of nitrogen and oxygen it is has not been ascertained, as the fact of its being a *chemical* compound was sufficient for the purpose intended, viz: of applying this waste product for the manufacture of ammonia.

At the commencement of the year 1856, I transferred a portion of the gases escaping from a vitriol chamber to my own laboratory, and there and then succeeded in converting them into ammonia.

This was an important step, but I did not feel satisfied until I had tried the process on the large scale; therefore, in November in the same year, an arrangement was entered into for this purpose with Messrs. Lewis and Pollard, of the Pontardawe Vitriol Works, whose kind assistance in the matter I take this opportunity of acknowledging.

The apparatus fitted up was of the following description:—A furnace was built above the exit tube of one of their vitriol chambers, and a brick gas retort, about 14 inches in diameter, 8 feet long, and open at both ends, was passed through its whole length. This retort was filled with charcoal, and kept at a red heat; the exit tube of the chamber, and a steam jet to supply the hydrogen, were attached to one end, whilst to the other end was fixed an upright leaden cylinder filled with coke, and moistened with diluted sulphuric acid. On passing the waste gases and steam through the retort containing red hot charcoal, both were decomposed, the oxygen of each uniting with the charcoal to form carbonic acid ( $C O_2$ ); the nitrogen and hydrogen combining to form ammonia ( $N H_4 O$, or, without water, $N H_3$ ); then together, probably forming carbonate of ammonia ( $N H_4 O_1 C O_2$ ), which was again decomposed by the diluted sulphuric acid, the sulphate of ammonia being found remaining in solution. This solution was then evaporated, and in July, 1857, I first had the pleasure of obtaining any quantity of crystals of sulphate of ammonia, by this process, from a vitriol chamber in actual work.

It was the intention at that time to have secured the invention by patent, and therefore, when the above comparatively rough result had been obtained, the further prosecution of the experiments to ascertain yield, &c., was not proceeded with, lest the process should become public. Several circumstances have since prevented their renewal. I therefore merely wish to offer the process as it is to those interested in the matter, hoping some one else may apply it more profitably than I have, and feeling sure that—as there seems no reason why it should not be successfully carried out—it will be the means of advancing the "arts, manufactures, and commerce" of this country, by increasing the supply of one of our most valuable fertilizers.

Perhaps it may be thought that the process is only adapted to such gases as escape directly from the chamber, and that, if any of the late

improvements as coke cylinders, &c., be used it cannot be applied; but provided the assertion be correct that sulphurous acid is incapable of reducing compounds of nitrogen and oxygen to their elementary state, then the process will be available after all these improvements have been carried out, and not only to the waste gases, but also, by a slight modification, to any nitrogen compounds that may have been absorbed by the dilute sulphuric acid, and be given off in its evaporation, so that really a very minute portion only of the nitrogen contained in the nitrate of soda need be lost.

With regard to the quantity obtainable by these means. I have not as yet been able to ascertain with certainty the amount of nitrate of soda imported, but, as already stated, it appears probable that about half of the whole quantity arriving in this country is used in the manufacture of oil of vitriol, or sulphuric acid. Now, every thousand tons of this cubic nitre, allowing 10 per cent. for impurities, would, if the whole of its nitrogen were converted into chloride of ammonia ($N H_4 O$), yield about 565 tons of this substance, which, at £30 per ton, would be worth nearly £17,000, and there are, doubtless, many thousands of tons of nitrate of soda used by the vitriol makers of this country.

Although these figures give, of course, no approximation to the practical yield likely to be afforded by this process, yet they enable us to form a very good idea of the enormous amount of valuable material daily wasted. The process suggested, or some modification of it, may render this waste unnecessary, and thus save the pocket of the manufacturer, and, at the same time, benefit the public.

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### *A new form of Barometer.* By M. DE CELLES.

This consists of two tubes united at right angles. The vertical branch being closed and the instrument filled as usual. The horizontal tube takes the place of the cistern, and a very slight diminution in the vertical column produces a great change in the length of the horizontal one—which is of much less diameter than the other. A steel index in front of the horizontal column will serve to register.

*Acad. Sciences of Paris.*

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### *Water in Lighthouses.**

Prof. Faraday writes to the *Times*, giving some useful information as to the purification of water contaminated with chloride of lead from salt spray resting on the leads of lighthouses, &c., whence rain-water is collected. The water thus contaminated is peculiar in this, that it does not lose the poisoning substance either by boiling or by exposure to air. The process of purification is exceedingly simple, for if some powdered chalk or whiting is put into the cistern in which such rain-water is collected, and stirred up occasionally after rain, the water may, with the greatest facility, be obtained in a perfectly fit state for all culinary and domestic purposes. The Trinity-house has supplied this information to all the cases needing it which have come to its knowledge.

* From the Lond. Builder, No. 570.

## FRANKLIN INSTITUTE.

*Proceedings of the Stated Monthly Meeting, November* 17, 1859.

John Agnew, Vice-President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Statistical Society, London; the Catholic University of Ireland, Dublin; the K. K. Geologischen Reichsanstalt, and the K. K. Geographischen Gesellschaft, Vienna, Austria; L. A. Huguet-Latour, Esq., Montreal, Canada; the Providence Athenæum, Providence, Rhode Island; and Prof. J. Aitkens Meigs, Philadelphia, Pa.

Donation to the Cabinet of Models and Minerals from Prof. John C. Cresson, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of November, was read.

The Board of Managers and Standing Committees reported their minutes.

Thirty-three resignations of membership in the Imstitute were read and accepted.

Candidates for membership in the Institute (17) were proposed, and the candidates proposed at the last meeting (17) were duly elected.

George M. Alsop exhibited an atmospheric spring for railroad cars, invented by him.

The principle on which this spring was constructed, was the application of a suitable fluid to surround a hermetically sealed air ball of rubber, inclosed in a water-tight chamber or vessel, having a flexible cover or diaphragm of rubber and leather, the latter being moulded so as to allow of considerable motion without being strained. The object of making use of a fluid to surround the air vessel, was stated to be to remedy the defect in the construction of all other air springs, viz: the gradual escape of the air, which the inventor thought would be accomplished by his arrangement, as the fluid would form the medium through which the pressure exerted upon the spring would act upon the air in the air vessel; and as the pressure within and outside the ball would always be the same, there would be no tendency in the air to escape.

Mr. Joseph Hoskin exhibited one of his "Sighted Adjustable Spirit Levels." It consists of a brass stock of box shape, planed and scraped truly. One end has a sight hole, and the other a glass affixed, across which the cross, of silk, passes. This sight is intended to do away with the necessity of using straight edges or lines when leveling from one object to another over an intervening space. The tubes are made adjustable by screws, and all of the usual sort; one for horizontal and the other for vertical work. The apparatus is got up with ease, and will, no doubt, exactly suit its intended purpose.

## *Abstract of Meteorological Observations for September, 1859; made in Philadelphia, Adams, and Somerset Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.*

| | PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer. | | | | | | | | GETTYSBURG, Adams Co. Lat. 39° 49′ N. Long. 77° 18′ W. Height 624 feet. Prof. M. JACOBS, Obs. | | | | | | SOMERSET, Somerset Co. Lat. 40° N. Long. 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer. | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1859. | Barometer. | | Thermometer. | | | Force of vapor. | Relative humidity. | | | Barometer. | | Thermom. | | | | Barometer. | | Thermom. | | Force of vapor. | Relative humidity. | | |
| Sept. | Mean. | Mean daily range. | Mean. | Daily oscillation. | Mean daily range. | 2 P.M. | 2 P.M. | Rain. | Prevail'g winds | Mean. | Mean daily range. | Mean. | Mean daily range. | Rain. | Prevail'g. winds | Mean. | Mean daily range. | Mean. | Mean daily range. | 2 P.M. | 2 P.M. | Rain. | Prevail'g winds |
| | Inch. | Inch. | ° | ° | ° | Inch. | Per ct. | Inches. | Direc. | Inch. | Inch. | ° | ° | Inch. | Direc. | Inch. | Inch. | ° | ° | Inch. | Per ct. | Inch. | Direc. |
| 1 | 29·731 | ·013 | 67·5 | 22¼ | 1·3 | ·591 | 89 | | S W. | 29·367 | ·004 | 66·7 | 0·4 | | WSW. | 27·594 | ·003 | 60·0 | 1·0 | ·416 | 52 | | W. |
| 2 | 29·724 | ·081 | 67·8 | 16¼ | 2·0 | ·255 | 29 | | W. | 29·391 | ·087 | 64·7 | 8·0 | | W. | 27·617 | ·056 | 56·0 | 6·7 | ·375 | 59 | | W. |
| ☽ 3 | 29·820 | ·117 | 68·7 | 27 | 5·2 | ·351 | 36 | 0·175 | S W. | 29·433 | ·094 | 65·8 | 10·5 | 0·01 | S W. | 27·640 | ·060 | 61·7 | 9·7 | ·498 | 55 | 0·120 | S W. |
| 4 | 29·841 | ·075 | 72·3 | 15 | 5·3 | ·614 | 68 | | W. | 29·479 | ·105 | 69·3 | 7·8 | | (var.) | 27·709 | ·087 | 61·7 | 7·3 | ·416 | 57 | | WNW |
| 5 | 30·035 | ·194 | 60·8 | 13 | 11·5 | ·412 | 77 | 0·175 | N N E. | 29·666 | ·187 | 57·7 | 11·7 | 0·130 | S W. | 27·817 | ·168 | 60·0 | 2·3 | ·391 | 54 | | (var.) |
| 6 | 30·077 | ·041 | 63·8 | 18 | 5·3 | ·326 | 42 | | N W. | 29·778 | ·112 | 58·3 | 6·0 | | N N E. | 27·917 | ·100 | 55·0 | 5·0 | ·300 | 48 | | N N E. |
| 7 | 30·116 | ·046 | 64·0 | 22 | 2·2 | ·376 | 46 | | N W. | 29·798 | ·022 | 59·0 | 3·3 | | S. | 27·896 | ·022 | 57·3 | 3·0 | ·411 | 60 | | (var) |
| 8 | 30·142 | ·026 | 65·2 | 23 | 1·5 | ·299 | 36 | | NNW. | 29·804 | ·012 | 60·0 | 2·3 | | (var.) | 27·904 | ·009 | 58·0 | 6·0 | ·435 | 57 | | E. |
| 9 | 30·120 | ·022 | 66·0 | 24 | 1·2 | ·428 | 51 | | S W. | 29·773 | ·035 | 63·3 | 3·3 | | S W. | 27·910 | ·013 | 64·3 | 6·3 | ·549 | 57 | | W. |
| 10 | 30·044 | ·076 | 70·5 | 22 | 4·5 | ·464 | 47 | | S S W. | 29·670 | ·110 | 71·0 | 7·7 | | S S W. | 27·828 | ·087 | 66·0 | 4·3 | ·574 | 69 | | WSW. |
| 11 | 29·714 | ·330 | 73·3 | 17 | 2·8 | ·592 | 60 | | S W. | 29·299 | ·364 | 71·7 | 1·3 | 0·010 | S W. | 27·552 | ·272 | 67·3 | 2·7 | ·654 | 81 | 0·635 | W. |
| ○ 12 | 29·523 | ·224 | 72·3 | 17½ | 1·7 | ·347 | 34 | | W. | 29·152 | ·147 | 69·3 | 2·3 | | W. | 27·435 | ·117 | 63·0 | 4·3 | 422 | 54 | | W. |
| 13 | 29·462 | ·064 | 69·0 | 24 | 3·3 | ·450 | 44 | | (var.) | 29·123 | ·112 | 65·7 | 5·7 | 0·100 | (var.) | 27·388 | ·084 | 54·3 | 8·7 | ·452 | 94 | 0·037 | (var.) |
| 14 | 29·787 | ·324 | 60·0 | 24 | 9·0 | ·265 | 34 | | N W. | 29·431 | ·309 | 60·0 | 7·0 | | N W. | 27·641 | ·253 | 51·7 | 5·3 | ·311 | 56 | | WNW |
| 15 | 30·099 | ·313 | 56·5 | 19½ | 3·5 | ·215 | 35 | | (var.) | 29·720 | ·288 | 55·0 | 5·0 | | N. | 27·830 | ·189 | 54·3 | 2·7 | ·355 | 62 | | S E. |
| 16 | 30·035 | ·065 | 57·8 | 10 | 4·7 | ·426 | 82 | 0·900 | E. | 29·651 | ·065 | 57·0 | 6·7 | } 3·386 | N N E | 27·721 | ·110 | 54·0 | 5·7 | ·390 | 93 | } 2·218 | S E. |
| 17 | 29·506 | ·529 | 60·3 | 9 | 3·2 | ·473 | 88 | 3·202 | N E. | 29·194 | ·457 | 58·3 | 6·3 | | N N E. | 27·519 | 201 | 56·0 | 2·0 | ·452 | 94 | | (var.) |
| 18 | 29·759 | ·253 | 64·2 | 20 | 5·5 | ·468 | 62 | | N W. | 29·436 | ·242 | 62·7 | 6·0 | | (var.) | 27·641 | ·122 | 62·0 | 6·7 | ·554 | 64 | | N W. |
| ☾ 19 | 29·753 | ·066 | 67·7 | 26 | 5·2 | ·549 | 57 | | S W. | 29·320 | ·116 | 66·7 | 9·3 | | S S W. | 27·511 | ·131 | 66·3 | 4·3 | ·676 | 66 | 0·252 | S W. |
| 20 | 29·728 | ·037 | 69·0 | 14 | 6·7 | ·658 | 90 | 0·822 | S W. | 29·285 | ·051 | 68·3 | 8·7 | 0·335 | S S E. | 27·457 | ·040 | 65·0 | 8·0 | ·564 | 80 | 0·172 | S S E. |
| 21 | 29·767 | ·039 | 66·0 | 13 | 5·0 | ·612 | 89 | 1·577 | N E. | 29·313 | ·028 | 68·3 | 5·0 | 1·650 | S. | 27·458 | ·005 | 66·7 | 1·7 | ·608 | 80 | 0·662 | S E. |
| 22 | 29·804 | ·042 | 63·2 | 10 | 5·8 | ·549 | 89 | 0·818 | N E. | 29·419 | ·106 | 62·0 | 7·7 | 0·716 | N N E | 27·585 | ·127 | 67·0 | 3·7 | ·563 | 61 | | W. |
| 23 | 29·838 | ·050 | 66·2 | 13½ | 6·0 | ·608 | 80 | | N W. | 29·508 | ·094 | 66·7 | 4·7 | 0·005 | N N E. | 27·696 | ·107 | 61·7 | 5·3 | ·469 | 67 | 0·025 | W. |
| 24 | 29·770 | ·083 | 69·0 | 15½ | 3·2 | ·497 | 54 | | S W. | 29·522 | ·072 | 63·7 | 3·3 | | N W. | 27·650 | ·046 | 56·3 | 5·3 | ·439 | 88 | 0·304 | W. |
| 25 | 29·765 | ·019 | 67·7 | 15 | 1·3 | ·524 | 62 | 0·110 | N E. | 29·526 | ·053 | 63·0 | 2·3 | | N. | 27·626 | ·029 | 59·7 | 4·0 | ·443 | 65 | | (var.) |
| ● 26 | 29·803 | ·039 | 67·2 | 18½ | 2·2 | ·554 | 64 | | (var.) | 29·491 | ·039 | 63·0 | 2·0 | | (var.) | 27·654 | ·028 | 60·3 | 2·7 | ·523 | 67 | 0·009 | (var.) |
| 27 | 29·849 | ·046 | 68·8 | 21 | 1·7 | ·587 | 61 | | WSW. | 29·481 | ·042 | 64·7 | 1·7 | | S. | 27·646 | ·008 | 61·7 | 4·0 | ·577 | 84 | 0·243 | S W. |
| 28 | 29·884 | ·068 | 72·0 | 16 | 3·8 | ·546 | 52 | | W. | 29·548 | ·067 | 67·7 | 3·7 | | (var.) | 27·766 | ·120 | 60·0 | 6·3 | ·509 | 74 | | N W. |
| 29 | 30·110 | ·226 | 64·8 | 16 | 7·2 | ·448 | 61 | | (var.) | 29·767 | ·209 | 62·0 | 5·7 | | (var.) | 27·856 | ·090 | 59·0 | 4·3 | ·469 | 67 | | S S E. |
| 30 | 30·131 | ·053 | 63·8 | 22 | 2·3 | ·389 | 50 | | N E. | 29·775 | ·042 | 64·0 | 2·0 | | S E. | 27·853 | ·021 | 58·3 | 4·0 | ·429 | 77 | | S E. |
| Means | 29·858 | ·119 | 66·2 | 18 | 4·1 | ·462 | 59 | 7·779 | N70¼W. | 29·503 | ·122 | 63·5 | 5·2 | 6·342 | S 84° W. | 27·677 | ·088 | 60·1 | 4·8 | ·474 | 68 | 4·678 | S 63¼ W. |

*Abstract of Meteorological Observations for September, 1859; made in Dauphin, Huntingdon, Centre, and Allegheny Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.*

| | Harrisburg, Dauphin Co. 40° 16′, N. 76° 15′, W. Height, 300 feet. John Heisely, M. D., Observer. | | | | | | Huntingdon, Huntingdon Co. Lat. 40° 35′ N. Long. 78° 3′ W. Height, 734 feet. W. Brewster, M. D., Observer. | | | | | | | | Fleming, Centre Co. 40° 55′ N. 77° 53′ W. Height, 780 feet. S. Brugger, Obs. | | | | Tarentum, Allegheny Co. 40° 37′ N. 79° 46′ W. Height 950 feet. J. H. Baird, Obs. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1859. | Barometer. | | Ther. | | | | Barometer. | | Ther. | | | | | | Thermom. | | | | Thermometer. | | |
| Sept. | Mean. | Mean daily range. | Mean. | Mean daily range. | Rain. | Prevail'g winds. | Mean. | Mean daily range. | Mean. | Mean daily range. | Force of vapor. 2. P M. | Relative humidity. 2 P.M. | Rain. | Prevail'g winds. | Mean. | Mean daily range. | Rain. | Prevailing winds. | Mean. | Mean daily range. | Prevailing winds. |
| | Inch. | Inch. | ° | ° | Inch. | Direc. | Inch. | Inch. | ° | ° | Inch. | Per ct. | Inch. | Direc. | ° | ° | Inch. | Direc. | ° | ° | Direc. |
| 1 | 29·637 | ·007 | 69·3 | 0·6 | | S W. | 29·232 | | 61·7 | | ·540 | 60 | | (var.) | 59·3 | 3·7 | | N W. | 61·7 | | S W. |
| 2 | 29·652 | ·089 | 68·0 | 5·3 | | N W. | 29·248 | ·074 | 62·3 | 8·7 | ·408 | 41 | | W. | 58·0 | 8·0 | | N W. | 58·3 | 10·0 | W. |
| ☽ 3 | 29·691 | ·093 | 70·0 | 8·0 | | S E. | 29·272 | ·081 | 63·0 | 12·7 | ·349 | 40 | | (var.) | 67·7 | 12·3 | | S W. | 64·0 | 13·0 | S W. |
| 4 | 29·762 | ·111 | 72·7 | 6·0 | | W. | 29·340 | ·109 | 65·7 | 9·3 | ·349 | 40 | | (var.) | 62·3 | 11·3 | | N W. | 60·0 | 10·7 | W. |
| 5 | 29·958 | ·199 | 63·0 | 9·7 | | S E. | 29·507 | ·166 | 58·7 | 8·3 | ·313 | 52 | | (var.) | 56 3 | 10·0 | | W. | 55·7 | 4·3 | (var.) |
| 6 | 30·051 | ·093 | 63·7 | 2·0 | | N W. | 29·613 | ·107 | 57·3 | 5·3 | ·231 | 34 | | (var.) | 55·3 | 7·0 | | (var.) | 52·7 | 5·0 | N. |
| 7 | 30·047 | ·023 | 63·0 | 2·0 | | S. | 29 595 | ·019 | 55·3 | 2·7 | ·348 | 51 | | N E. | 55·7 | 1·0 | | N W. | 55·3 | 2·7 | N W. |
| 8 | 30·065 | ·018 | 63·7 | 0 7 | | N. | 29·020 | ·023 | 56·7 | 1·3 | ·384 | 52 | | | 57·3 | 5·0 | | (var.) | 55·7 | 2·3 | (var.) |
| 9 | 30·051 | ·014 | 68·0 | 4·3 | | N. | 29·576 | ·040 | 62·3 | 5·7 | ·435 | 48 | | | 62·3 | 5·0 | | N W. | 63·0 | 7·3 | S. |
| 10 | 29·919 | ·132 | 74·7 | 6·7 | | S E. | 29·462 | ·114 | 69·3 | 7·0 | ·522 | 51 | 0·018 | (var.) | 70 0 | 7·7 | 0·160 | W. | 69·7 | 8·0 | S W. |
| 11 | 29·580 | ·339 | 74·7 | 3·3 | 0·072 | S W. | 29·173 | ·289 | 69·0 | 5·0 | ·667 | 85 | 0·197 | S E. | 69·7 | 3·7 | 0·162 | N W. | 71·3 | 3·7 | S W. |
| ○ 12 | 29·409 | ·171 | 73·3 | 2·7 | | N W. | 29·034 | ·139 | 65·7 | 6·7 | ·421 | 45 | | S E. | 62·7 | 7·0 | | N W. | 64·7 | 6·7 | S W. |
| 13 | | | | | | ? | 29·010 | ·121 | 62·0 | 7·7 | ·475 | 69 | | W. | 61·3 | 4·7 | 0·020 | N W. | 63·0 | 6·3 | (var.) |
| 14 | 29·695 | | 62·7 | | | N W. | 29·297 | ·287 | 58·3 | 3·7 | ·244 | 37 | | W. | 54·0 | 7·3 | | (var.) | 53·7 | 9·3 | W. |
| 15 | 30·058 | ·364 | 56·3 | 6·0 | | S. | 29·581 | ·284 | 51·0 | 7·3 | ·255 | 46 | | S E. | 49·3 | 4·7 | | S W. | 57·7 | 4·7 | N E. |
| 16 | 29·932 | ·126 | 56·0 | 5·0 | } 5·063 | E. | 29·466 | ·115 | 56·0 | 7·7 | ·375 | 93 | } 3·170 | N E. | 52·0 | 8·0 | } 3·180 | E. | 57·0 | 5·3 | S. |
| 17 | 29·495 | ·437 | 60·3 | 4·3 | | (var.) | 29·155 | ·311 | 57·7 | 5·0 | ·452 | 94 | | N. | 59·0 | 7·0 | | N W. | 59·0 | 2·0 | W. |
| 18 | 29·698 | ·203 | 65·3 | 4·7 | | W. | 29·283 | ·128 | 60·7 | 5·7 | ·366 | 52 | | N W. | 61·3 | 7·0 | | (var.) | 57·3 | 4·3 | W. |
| ☾ 19 | 29·609 | ·092 | 68·7 | 7·3 | | S W. | 29·162 | ·121 | 68·7 | 8·7 | ·573 | 58 | | S E. | 62·3 | 6·3 | | (var.) | 65·7 | 11·0 | S W. |
| 20 | 29·577 | ·049 | 71·7 | 7·7 | } 3·83 | S. | 29·117 | ·057 | 67·7 | 6·3 | ·631 | 80 | | (var. | 70·7 | 7·0 | 0·100 | (var.) | 69·0 | 7·7 | (var.) |
| 21 | 29 609 | ·032 | 70·3 | 4·0 | | E. | 29·138 | ·021 | 66·7 | 3·0 | ·665 | 77 | 0·280 | (var.) | 68·7 | 2·0 | 0·775 | S E. | 70·7 | 2·7 | (var.) |
| 22 | 29·701 | ·092 | 62·0 | 9·7 | | (var.) | 29·240 | ·102 | 64·7 | 4·7 | ·594 | 76 | | (var. | 66·3 | 3·0 | 0·175 | E. | 66·3 | 4·3 | S. |
| 23 | 29·755 | ·054 | 68·7 | 6·7 | | (var.) | 29·303 | ·064 | 66·3 | 3·0 | ·469 | 52 | | (var. | 65·3 | 3·0 | | (var.) | 60·7 | 5·7 | S. |
| 24 | 29·719 | ·059 | 68·3 | 0·3 | | (var.) | 29·302 | ·031 | 60·7 | 5·7 | ·516 | 84 | 0·041 | S E. | 64·7 | 3·3 | | (var.) | 60·0 | 2·0 | S W. |
| 25 | 29·602 | ·040 | 67·3 | 1·0 | | W. | 29·272 | ·030 | 63·0 | 3·0 | ·608 | 80 | | (var. | 64·0 | 2·0 | 0·113 | (var.) | 62·3 | 2·3 | ? |
| ● 26 | 29 [illegible] | ·046 | 68·0 | 1·3 | | W. | 29·295 | ·023 | 61·7 | 4·7 | ·469 | 52 | | (var. | 64·3 | 3·0 | | (var.) | 60·3 | 2·7 | S W. |
| 27 | 29 [illegible] | ·024 | 68·7 | 2·0 | | S. | 29·285 | ·012 | 66·0 | 4·3 | ·536 | 54 | 0·055 | var. | 65·3 | 3·0 | 0·170 | S W. | 63·0 | 4·7 | ? |
| 28 | 29 [illegible] | ·095 | 70·7 | 4·0 | | W. | 29·385 | ·101 | 65·3 | 4·0 | ·567 | 68 | | W. | 67·3 | 7·3 | | S W. | 58·7 | 6·3 | W. |
| 29 | 29 [illegible] | ·216 | 64·3 | 6·3 | | W. | 29·564 | ·178 | 58·3 | 7·0 | ·448 | 61 | | S E. | 57·7 | 9·7 | | (var.) | 58·7 | 2·7 | N E. |
| 30 | 30 [illegible] | ·052 | 65·3 | 3·0 | | S E. | 29·554 | ·039 | 60·7 | 5·7 | ·451 | 73 | | (var). | 61·0 | 5·3 | | (var.) | 63·7 | 5·0 | (var.) |
| Means | 29·783 | ·117 | 66·8 | 4·5 | 8·965 | s 81°w | 29·336 | ·110 | 62·1 | 5·9 | ·459 | 60 | 3·761 | s.54°e. | 61·7 | 5·8 | 4·655 | west. | 61·3 | 5·4 | s. 61° w. |

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